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(Recognosce notum, ignotum inspice.)

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British Mycological Society.

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* Ordinary Members are denoted by an asterisk after the number.

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82. United States, Department of Agriculture.
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84. Watson, Dr. W., Deputy Surgeon General, University Club, Edinburgh.
85. Weiss, Professor F. E., Owen's College, Manchester.
86.* Welsford, Miss E. J., F.L.S., Royal Holloway College, Englefield Green, Surrey.
87. Woolhope, The Naturalists' Field Club, Hereford.

OFFICERS FOR THE SEASON 1907.

President: Miss Annie Lorrain Smith, F.L.S., 20, Talgarth Road, West Kensington, London, S.W.

Vice-President: Arthur Lister, F.R.S., Leytonstone, Essex, and Highcliff, Lyme Regis.

Hon. Secretary and Treasurer: Carleton Rea, B.C.L., M.A., &c., 34, Foregate Street, Worcester.

RULES.

Society's name and objects.

1. The Society shall be called "The British Mycological Society," and its objects shall be the study of Mycology in all its branches, systematic, morphological and pathological, the publication of annual reports recording all recent discoveries in any branch of mycology, and more especially giving a brief synopsis of the work of European Mycologists and the recent additions to the British Fungus Flora.

Members of Society.

2. The Society shall consist of Foundation Members, Honorary Members and Ordinary Members, the number of Foundation Members shall be limited to 100 and that of Honorary Members to 20, but the number of Ordinary Members shall be unlimited.

Foundation Members.

3. Foundation Members shall consist of those Members and Clubs who joined the Society previous to the limit of 100 Members of the Society having been attained, but after this number has been attained no Person or Club shall be admitted as a Foundation Member.

Honorary Members.

4. Honorary Members shall be Ladies or Gentlemen of pre-eminence in Mycology, or who have rendered special service to the Society.

Ordinary Members.

5. Ordinary Members shall be Ladies or Gentlemen elected as hereinafter set out.

Election of Members.

6. Until the limit of 100 Foundation Members be reached any person or Club may signify their desire of joining the British Mycological Society and will consequently be enrolled as Members thereof by the Secretary. Honorary Members shall only be elected at a meeting of The British Mycological Society by the majority of the Members then present. Ordi-

nary Members shall be elected either by the majority of the Members then present at the annual meeting, or meetings, or by the President, Vice-President, Treasurer, and Hon. Secretary at other times. All Ordinary Members shall be proposed and seconded respectively by existing Members, who shall sign a certificate (see appendix) in recommendation of him or her, one at least of the proposers so certifying from personal knowledge, and every candidate for election shall sign an undertaking to abide by the Rules if elected (see appendix).

Yearly Subscription. 7. All Ordinary Members and Clubs shall pay an annual subscription of 10/- and Foundation Members 5/-, and the same shall be due by the First of January in each year, whilst Honorary Members shall be exempt from any annual subscription. Any Member wishing to retire from the Society shall give notice to the Hon. Secretary in writing before 1st of December of the previous year, otherwise he shall be liable for the annual subscription for the next year.

Government of the Society. 8. The management of the British Mycological Society shall be vested in the President, Vice-President, Treasurer, and Hon. Secretary.

Election of Officers. 9. The President, Vice-President, Treasurer, and Hon. Secretary shall be elected annually, at the first meeting of the British Mycological Society in each year, by a majority of the Members then present.

Meetings of Forays. 10. The British Mycological Society shall hold one or more meetings annually at a place and time determined by the Members at the previous meeting, or in default thereof, by the President, Vice-President, Treasurer, and Secretary. Invitation from Local Societies shall be first entertained and the acceptance of such shall imply that the Local Society undertakes to arrange the excursions of the foray, obtain necessary permissions from landowners, and place at the disposal of the British Mycological Society a room, free of cost, for the exhibition of specimens, delivery of addresses, and the transaction of business.

Accounts to be annually furnished and vouched.

11. At the first meeting of the British Mycological Society in each year the Hon. Secretary shall produce an account of the receipts and disbursements for the previous year, duly vouched by the Hon. Treasurer, or if the two offices be combined, then by an independent Member of the Society.

Payment of Expenses.

12. At each Meeting the Members then present must pay to the Hon. Secretary their share of the expenses incurred.

Election of Chairman in absence of President and Vice-President.

13. In the absence of the President and Vice-President, the Members present at any meeting shall elect a Chairman for that Meeting.

Rarities to be recorded.

14. Members finding rare specimens, or specimens new to the British Fungus Flora, are requested to immediately communicate the fact to the Hon. Secretary, together with full descriptions, the locality, habitat, and the date thereof, and the Hon. Secretary shall report the same at the next meeting of the Society.

Every Member to have a copy of these Rules and any alteration thereof.

15. A printed copy of these Rules shall be sent to every Member of the Society on election, and to all Members on their alteration.

APPENDIX.

Form of proposal for Ordinary Membership of the British Mycological Society.

____

*of*____

____

being desirous of becoming an Ordinary Member of the British Mycological Society, we, the undersigned Members of the Society, certify that we consider h to be a desirable Member of the Society, and beg to recommend h for election.

Dated this day of 19

______________________________(From personal knowledge).

____

Certificate to be signed by the Candidate.

I hereby certify that I desire to become an Ordinary Member of the British Mycological Society and that I will abide by the Rules if elected.

____

THE NEWCASTLE-UPON-TYNE FORAY.

30th September to the 4th October, 1907.

The eleventh annual week's Fungus Foray of the British Mycological Society was held at Newcastle-upon-Tyne, on the invitation of Professor M. C. Potter, M.A., one of the members, the Council of the Armstrong College most kindly placing the rooms of the Botanical Department at the disposal of the Society as their headquarters, together with text books and microscopes for the determination of the specimens. The majority of the members were comfortably housed at the Grand Hotel, which was within two minutes' walk of the College. Here they assembled on the evening of Monday, the 30th of September, when the following specimens were placed out on exhibition:—*Cortinarius (Phlegmacium) varius* Fr., from Aberdour, by Dr. W. Watson; *Hydnum ferrugineum* Fr. and *Collybia semitalis* Fr., from Glenurquhart, *Pholiota aegerita* Fr. and *Flammula sapinea* Fr., from Rothiemurchus, by Mr. Angus Grant; *Hydnum zonatum* Batsch, *nigrum* Fr. and *melaleucum* Fr., by Mr. A. D. Cotton, F.L.S.; and *Polyporus borealis* Fr., *Polystictus radiatus* Fr., and *Trametes rubescens* (A. & S.) Fr., by Mr. Charles Crossland, F.L.S., who also exhibited some excellent paintings, including *Paxillus paradoxus* Berk. and an undescribed *Peziza*.

On Tuesday, the first of October, the members booked by the 9.35 train from the Central Railway Station to Alnwick. Arriving there at eleven o'clock, they were met by Mr. A. T. Gillanders, who conducted them through the town of Alnwick up to the Castle, where some of the rooms and priceless art treasures were open to their inspection by the kind direction of the Duke and Duchess of Northumberland. The Park was then explored for some distance along the side of the river Aln, and through some shrubberies past a nursery to Mr. Gillander's house. The sawmills at the back of this house were carefully inspected, and a little further on some old timbers that had been left lying about were overhauled with the assistance of some workmen. Several small coverts were next investigated, and the walk was continued across the Park to the ruins of Hulne Abbey, where a welcome cup of tea was partaken of. The remainder of the Park had to be traversed rather hurriedly, as time was short. However, the President (Miss A. Lorrain

Smith, F.L.S.) and Mrs. Carleton Rea managed to secure some specimens of *Hygrophorus discoxanthus* (Secr.) Fr., an addition to the British Fungus Flora. The other specimens most worthy of note were *Cortinarius (Phlegmacium) triumphans* Fr., *Cortinarius (Phlegmacium) claricolor* Fr., *Psilocybe sarcocephala* Fr., *Trogia crispa* Fr., *Russula Queletii* Fr., *Peziza succosa* Berk., *Quaternaria Persoonii* Tul., and *Botryosporium pulchrum* Cda. In the evening at nine o'clock the business meeting of the Society was held at the headquarters. Mr. Carleton Rea, B.C.L., M.A., &c., was unanimously elected President for the ensuing year, and he was further requested to retain the offices of Hon. Secretary and Treasurer; Mr. Arthur Lister, F.R.S., was re-elected Vice-President. The Cryptogamic Society of Scotland proposed that the two Societies should hold a joint meeting on the 14th of September, 1908, at Drumnadrochit, and this suggestion was unanimously adopted, the consideration of the Rev. H. Purefoy FitzGerald's invitation to visit the neighbourhood of Wellington College being deferred to the next meeting. The Hon. Treasurer reported that the sum of £23. 4s. 11d. stood to their credit, as against the sum of £25. 10s. 1d. at the same period in the previous year, but the diminution in the amount was due to the cost of the Index to Volume II. and to the publication of the advance copy of the paper on "How to Distinguish the Species of British Lycoperda in the Field." Their present roll of membership numbered 75, an increase of five for the year. At the request of the Hon. Secretary of "The British Science Guild," the attention of the members was drawn to the objects of that Association, which has the support of our leading scientific men and women, and includes our present President in its list of members. Mr. V. H. Blackman, F.L.S., represented the Society at the Conference of Delegates of Corresponding Societies at the meeting of the British Association at Leicester; and Mr. Carleton Rea, on behalf of the Society, read a paper there, entitled "A Plea that Local Societies should give greater attention to the investigation of the Fungi occurring in their districts, with suggestions for the encouragement of the study of this group." Mr. W. E. St. John Brooks, of the British Museum, Cromwell Road, South Kensington; Mr. H. G. Hawley, of Tunby Lawn, Boston, Lincolnshire; and Mr. Harry Quilter, of 2, Draper Street, Leicester, were unanimously elected members.

On Wednesday, the 2nd of October, the members were occupied during the morning placing out on exhibition the finds of the previous day. At 12.40 they took the train from the Central Railway Station to Corbridge. Here Professor M. C. Potter conducted them along a path by the side

of the railway, and incidentally pointed out a serious disease of swedes in an adjoining field, which he attributed to *Phoma brassicæ* (Thüm) Sacc. The high road was then followed to Dilston Castle, many examples of *Polyporus hispidus* Fr. being noticed on the way. A traverse was then taken past some old ruins down to the Devil's Water, where the members dispersed in different directions, but all reunited at the railway station in time to catch the return train at 5.37. It was subsequently ascertained that Mr. G. C. Hughes had collected *Inocybe Godeyi* Gillet, *Inocybe petiginosa* (Fr.) Quél, and *Hygrophorus calyptraeformis* Berk; Mr. Angus Grant *Amanita spissa* Fr., Mr. A. D. Cotton, F.L.S., *Boletus aestivalis*, Fr., and Mrs. Carleton Rea *Coryne atrovirens* (Pers.) Sacc.

In the evening the annual Club Dinner was held at the Grand Hotel at seven o'clock. Afterwards at the headquarters the President (Miss A. Lorrain Smith) delivered her Presidential Address, entitled "Microfungi: A Historical Sketch" (see p. 18), and on its conclusion drew the attention of the members to several new and interesting additions to the British Fungus Flora, all of which are fully set out in the paper on "New and Rare British Fungi" (see p. 34).

The President then requested the Hon. Secretary to read a paper by Dr. M. C. Cooke, "Review of Comments on 'Illustrations of British Fungi' Transactions, 1906, p. 150" (see p. 26), and a communication by C. B. Plowright. M.D., "On Six Fatal Cases of Poisoning by *Amanita phalloides* at Ipswich in September, 1907" (see p. 25). At the conclusion of Dr. Plowright's paper it was agreed that most of the fatal cases of poisoning by so-called mushrooms was attributable to *Amanita phalloides*, or to the nearly allied species *A. mappa* or *A. pantherina*, which are so dissimilar to the edible mushroom that it seems incredible that persons in this country should confuse them. On the Continent, where these species are the cause of over a hundred deaths annually, this is due to the fact that there the peasantry are accustomed to eat a great number of different species, and so are more liable to make an erroneous determination. On the whole, it seemed best for the Society to advocate that all *Amanitae* and *Volvariae* should be rejected as a possible source of food, although some of them have undoubted palatable qualities. They are easily distinguished by the *Volva* at the base of the stem, called by the Americans "the poison cup," and every effort should be made to emphasize the importance of, in all cases, securing the base of the stem intact and uninjured in order that this character could be noted, instead of breaking the stem off short, as careless collectors are apt to do.

On Thursday, the 3rd of October, the forenoon was again

employed in the investigation of critical species, and then at 1.18 the members proceeded by train to Starward-le-Pele, arriving there at 2.32. Here a beautiful wooded ravine on the river Allan was thoroughly searched by the members. Some of them, dissatisfied with the dry conditions obtaining on the eastward bank of the river, braved the difficulty of crossing the Allan, only to find that the vegetation on the west side of the river was too rank, and yielded nothing worthy of record. Those who remained on the right bank of the river were more successful, Mrs. M. C. Potter gathering a beautiful clump of the somewhat rare *Polyporus umbellatus* Fr., and specimens of *Lepiota Friesii* (Lasch.) Fr. and *Helminthosporium exasperatum* B. & Br. were also obtained. The return train from Starward-le-Pele was taken at 6.57, and Newcastle-upon-Tyne reached at 8.30.

On Friday, the 4th of October, the first part of the morning was devoted to an inspection of Jesmond Dene, a charming park-like ravine within a mile of the centre of Newcastle, but the ground was found to be very dry and unproductive, and so furnished no additions to the list of Fungi already collected. At mid-day the train was taken to Rowlands Gill Station, from which a short walk led to the entrance to Gibside, kind permission to explore this estate having been granted by Lord Strathmore. Here the members were met by Mr. R. S. Bagnall, F.E.S., who had kindly offered to act as guide, and they were very greatly indebted to him for conducting them to many of the most suitable hunting grounds on this interesting estate during the short time that remained at their disposal. The ground was delightfully moist in many places, and several rotten trees were found lying about, which were carefully examined. About 180 species were observed in the course of the afternoon, and included *Hypholma dispersum* Fr., *Hygrophorus unguinosus* Fr., *Marasmius Hudsoni* (Pers.) Fr., *Trametes mollis* Fr., an extreme deep indigo form of *Helvella lacunosa* Afzl., *Chlorosplenium aeruginosum* (Fr.) de Not., *Lamproderma physaroides* Rost., and *Amaurochaete atra* Rost.

In the evening at the headquarters, at 8.45, Mr. A. D. Cotton, F.L.S., read a paper, entitled "Further Notes on British Clavariae" (see p. 29), and the Hon. Secretary made a few remarks on some recent additions to the British Fungus-Flora list illustrated by paintings by Mrs. Carleton Rea (see p. 34). These included *Omphalia velutina* Quél, *Inocybe proximella* Karst., *Inocybe duriuscula* Rea, *Craterellus pusillus* Fr., and an undetermined *Calathinus*. It was announced that the Rev. W. L. W. Eyre had most generously offered to bear the expense of a plate illustrating *Inocybe proximella* and *Craterellus pusillus*. Hearty votes of thanks were then accorded to the Council of the Armstrong College for the use of the rooms in the Botanical

Department; to their fellow-member, Professor M. C. Potter, M.A., for all the trouble and care that he had taken in making the arrangements for the week's Foray; and to the Duke of Northumberland, Lord Strathmore, and other landowners for the kind permissions to visit their estates.

Fungi were very scarce in the neighbourhood of Newcastle-upon-Tyne, and it is presumed that the somewhat favourable conditions for their growth in early summer being succeeded by the drought of the latter end of August and September, the mycelium that was then running was killed, and it was thus easy to account for the paucity of specimens that were observed on each day of the Foray. Only a total of some two hundred and eighty-five species were identified during the week, which, however, in this unfavourable year must be accepted as satisfactory in comparison with what our confreres of France were able to obtain during their Foray last year, when only some one hundred and forty odd species were passed in review. The President subsequently reported that she had found at Alnwick on *Lychnis* a Deuteromycete new to Britain, namely, *Marssonia Delastrei* Sacc. and the somewhat rare Acrasian *Dictyostelium mucoroides* Bref.

COMPLETE LIST OF FUNGI GATHERED DURING THE FORAY.

A—Alnwick; C—Corbridge; G—Gibside;
S—Starward-le-Pele.

Amanita mappa (Batsch) Fr. G., muscaria (Linn.) Fr. A., rubescens Pers. G., spissa Fr. C.

Amanitopsis vaginata (Bull.) Roze A. C. S.

Lepiota Friesii (Lasch.) Fr. S., acutesquamosa (Weinm.) Fr. C., carcharias Pers. G., granulosa (Batsch) Fr. A. C. G., amianthina (Scop.) Fr. C. G.

Armillaria mellea (Vahl.) Fr. G.

Tricholoma albobrunneum (Pers.) Fr. G., rutilans (Schaeff.) Fr., imbricatum Fr. G., terreum (Schaeff.) Fr. G., saponaceum Fr. A., cuneifolium Fr., lascivum Fr. C., personatum Fr. A., panaeolum Fr. C.

Clitocybe nebularis (Batsch) Fr. A. G., clavipes (Pers.) Fr. G., cerussata Fr. A., infundibuliformis (Schaeff.) Fr., ditopa Fr. A., fragrans (Sow.) Fr. A.

Laccaria laccata (Scop.) Br. var. amethystina (Vaill.) B. & Br. G. S.

Collybia radicata (Relh.) Fr. G., platyphylla Fr. G., maculata (A. & S.) Fr. C. G., butyracea (Bull.) Fr. G., tuberosa (Bull.) Fr. G.
Mycena gypsea Fr. A., rugosa Fr., galericulata (Scop.) Pers., polygramma (Bull.) Pers. A. G., alcalina Fr. G., filopes Bull., amicta Fr. C., sanguinolenta (A. & S.) Fr. A., galopa Pers. A. G., capillaris Fr. A. C. G.
Omphalia rustica Fr. A., grisea Fr., integrella (Pers.) Fr. A.
Pluteus cervinus (Schaeff.) Fr. A. C. G.
Entoloma jubatum Fr. G., nidorosum Fr. C.
Nolanea pascua (Pers.) Fr. G., pisciodora (Cesati) Fr. G.
Pholiota squarrosa (Müll.) Fr. C., mutabilis (Schaeff.) Fr. G.
Inocybe Godeyi Gillet C., rimosa (Bull.) Fr. A. C. G., geophylla (Sow.) Fr. A. C. G., petiginosa (Fr.) Quél. C.
Hebeloma fastibile Fr., mesophaeum Fr. A., crustuliniforme (Bull.) Fr. A. G.
Flammula sapinea Fr. A. C. G.
Naucoria semiorbicularis (Bull.) Fr. C.
Galera tenera (Schaeff.) Fr., hypnorum (Batsch) Fr. A. G.
Tubaria furfuracea (Pers.) W. G. Sm.
Stropharia aeruginosa (Curt.) Fr., squamulosa Massee C. G., albo-cyanea (Desm.) Fr. C., squamosa Fr. A., semiglobata (Batsch) Fr.
Hypholoma sublateritium (Schaeff.) Fr., capnoides Fr. G., epixanthum Fr. G., fasciculare (Huds.) Fr., dispersum Fr. G., pyrotrichum (Holmsk.) Fr. A.
Psilocybe sarcocephala Fr. A. C. G., semilanceata Fr. A. C. G.
Psathyra fibrillosa (Pers.) Fr. C.
Anellaria separata (Linn.) Karst.
Panaeolus sphinctrinus Fr. C., campanulatus (Linn.) Fr.
Psathyrella atomata Fr.
Coprinus niveus Fr., micaceus Fr. G., plicatilis (Curt.) Fr.
Bolbitius fragilis Fr. A. C., titubans Fr. A.
Cortinarius (Phlegmacium) triumphans Fr. A., claricolor Fr. A.
(Myxacium) elatior Fr. A. C. G.
(Dermocybe) tabularis Fr. G., caninus Fr. G., anomalus Fr. G.
(Telamonia) hinnuleus Fr. A. C. G.
Paxillus involutus (Batsch) Fr. A. C. G.
Hygrophorus discoxanthus (Secr.) Fr. A., nemoreus Fr. A., pratensis Fr. virgineus Wulf., niveus Fr., coccineus (Schaeff.) Fr., miniatus Fr., puniceus Fr. A. G., calyptraeformis Berk., chlorophanus Fr. A. C. G., unguinosus Fr. G.
Lactarius turpis (Weinm.) Fr. G., blennius Fr., circellatus Fr. G., uvidus Fr. C., pyrogalus (Bull) Fr. A., vietus Fr. A. S. G., glyciosmus Fr., serifluus Fr. A. C. G., mitissimus Fr. G., subdulcis Fr.

Russula chloroides (Krombh.) Bres. A., furcata Pers. A. G., rosacea Pers. A., caerulea Pers. C., drimeia Cke., incarnata Quél. G., lepida Fr. A., vesca Fr., cyanoxantha (Schaeff) Pers., galochroa (Bull.) Fr. A., foetens Pers. C., fellea Fr., Queletii Fr. A., emetica Pers. G., ochroleuca Pers. A. C. G., fragilis Pers., var. violacea Quél. A.C.G., var. fallax Cke. A.

Cantharellus cupulatus Fr. A.

Marasmius peronatus (Bolt.) Fr. G., oreades (Bolt.) Fr. A. G., ramealis (Bull.) Fr. A., androsaceus (Linn.) Fr., rotula Fr. A. C. G., Hudsoni (Pers.) Fr. G., epiphyllus Fr. A. C. G.

Lentinus cochleatus (Pers.) Fr.

Trogia crispa Fr. A. C.

Boletus elegans (Schum.) Fr., badius (Linn.) A. G., piperatus (Bull) C., chrysenteron Fr. C. G., subtomentosus (Linn) G., edulis (Bull.) G., aestivalis Fr. C., luridus (Schaeff) G., laricinus (Berk.) A., scaber Fr. A. C. G.

Polyporus squamosus (Huds.) Fr. A., varius Fr. A. C., umbellatus Fr. S., giganteus Fr. A., sulphureus Fr. G., hispidus Fr. C., betulinus (Bull.) Fr. G., borealis Fr., fumosus Fr. G., adustus Fr. A. C. G.

Fomes connatus Fr. C., annosus Fr., applanatus (Wallr.) Fr. A., ferruginosus (Fr.) Mass.

Polystictus versicolor (Huds.) Fr., radiatus Fr. C., velutinus Fr. C., abietinus Fr. S.

Poria vaporaria Fr., mollusca Fr. A.C.G., vulgaris Fr. G., medulla-panis Pers. G., blepharistoma B. & Br. C., obducens Pers. G.

Trametes serpens Fr. C., mollis Fr. A. C. G.

Merulius lacrymans Fr. A.

Hydnum repandum Linn., alutaceum Fr. A.

Irpex spathulatus (Schrad.) Fr. C. G., obliquus Fr. G.

Grandinia granulosa Fr., crustosa Fr.

Solenia anomala Fr. A.

Thelephora laciniata Pers.

Stereum hirsutum Fr., rugosum Fr. A. G.

Hymenochaete rubiginosa Lév.

Corticium calceum Fr.

Peniophora quercina (Fr.) Cke., cinerea (Berk.) Cke.

Coniophora sulphurea Mass. C., puteana (Schum.) Fr.

Clavaria muscoides (Linn.) C. G., cristata (Pers.) A., rugosa (Bull.) A., fusiformis (Sow.) A., dissipabilis (Britz.) A. C. G., vermicularis (Scop.) C.

Typhula Grevillei Fr. G.

Tremella mesenterica (Retz.) A.

Dacryomyces deliquescens Duby. C., stillatus Nees. A. G.

Calocera viscosa Fr.
Sphaerobolus stellatus Tode.
Lycoperdon pyriforme (Schaeff.), perlatum (Pers.), caelatum (Bull.) A.
Scleroderma vulgare Fr. G., verrucosum Pers. G.
Ithyphallus impudicus (Linn.) Fisch. G.
Puccinia lapsanae (Schultz.) Fckl. A. C.
Urocystis anemones (Pers.) Schröt. A. C. G. On *Ranunculus repens.*
Pilobolus crystallinus Tode.
Pilaira anomala Schröt. A. G.
Spinellus fusiger Van Tiegh. A. C.
Sporodinia aspergillus Schröt. A. C., grandis Link. G.
Piptocephalis Freseniana De Bary. A.
Erysiphe communis (Wallr.) Fr. G. On *Hypericum.*
Nectria cinnabarina (Tode) Fr. The conidial form.
Hypomyces chrysospermus Tul. The conidial form. aurantius (Pers.) Tul.
Hypocrea rufa (Pers.) Fr. The conidial form.
Claviceps microcephala (Wallr.) Wint. A. C. G.
Chaetosphaeria phaeostroma (Dur. & Mont.) Fckl. S.
Rosellinia aquila (Fr.) de Not.
Leptosphaeria doliolum (Pers.) Ces. & de Not. C., acuta (Moug. and Nestl.) Karst. C.
Quaternaria Persoonii Tul. The conidial form. A. C. G.
Diatrypella quercina (Pers.) Nitsche. A. G.
Diatrype stigma (Hoffm.) de Not. G., disciformis (Hoffm.) Fr. G.
Hypoxylon fuscum (Pers.) Fr., coccineum Bull. G.
Ustulina vulgaris Tul. S. G.
Xylaria hypoxylon (Linn.) Grev., polymorpha (Pers.) Grev. C. G. A.
Phyllachora graminis (Pers.) Fckl. C.
Leotia lubrica Pers. A.
Helvella crispa Fr. C., lacunosa Afzel. G.
Otidia aurantia (Pers.) Mass. G.
Peziza succosa Berk. A.
Humaria granulata Sacc.
Dasyscypha nivea (Hedw.) Mass., calycina (Schum.) Mass. C. G. S.
Lachnea scutellata (Linn.) Gillet. C. G.
Chlorosplenium aeruginosum (Fr.) de Not. G.
Helotium citrinum Fr., scutula (Pers.) Karst. G.
Mollisia cinerea (Batsch) Karst. S.G.
Ascobolus furfuraceus Pers. A. C. G.
Coryne urnalis (Nyl.) Sacc. A. C., sarcoides Tul. G., atrovirens (Pers.) Sacc. C. G.
Orbilia leucostigma Fr.
Rhytisma acerinum (Pers.) Fr.

Marssonia Delastrei Sacc. on *Lychnis*, A. New to Britain.
Cylindrium flavo-virens Bon.
Botryosporium pulchrum Cda. A.
Trichothecium roseum Link C. G.
Zygodesmus fuscus Cda.
Rhacodium cellare Pers. A. C.
Cladosporium epiphyllum Mart.
Helminthosporium exasperatum B. & Br. S.
Heterosporium epimyces C. & M.
Stilbum fimetarium B. & Br. A.
Aegerita candida Pers. C.
Graphium subulatum (Nees.) Sacc. A.
Ptychogaster albus Cda.

*Mycetozoa.**

Physarum nutans Pers. G.
Spumaria alba DC. G.
Stemonitis fusca Roth. A. C. G.
Lamproderma physaroides Rost. G.
Amaurochaete atra Rost. G.
Trichia affinis De Bary A. G., varia Pers. A. C. G.
Arcyria albida Pers. A., var. pomiformis Lister. G., punicea Pers. G.
Lycogala miniatum Pers. G.
Dictyostelium mucoroides Bref. A.

* These were kindly determined by Mr. Arthur Lister, F.R.S.

PRESIDENTIAL ADDRESS.

By Annie Lorrain Smith, F.L.S.

MICROFUNGI:

A HISTORICAL SKETCH.

In choosing a subject for a Presidential address, it is customary and proper to give the preference to some department of knowledge in which the speaker has been specially interested. That custom must be my apology for selecting microfungi. The difficulty attending the detection and examination of these minute plants has discouraged many would-be students; but from time to time enthusiastic botanists have searched for them, and have found pleasure and interest in observing their curious forms, and I have attempted to give an account of the development of this branch of mycological science, more especially in our own country, from the earliest recorded descriptions and figures known to us.

Mildews and moulds have long been familiar terms, but they have been used mainly to indicate mysterious blights on the higher plants, or the natural accompaniment of decay. More exact knowledge was impossible until compound microscopes had been invented. It is generally believed that the first of these instruments was made by Zacharias Jansen, a Dutchman, about the end of the 16th century. One was brought over to England in 1619, and was shown to James I. by his astronomer, Cornelius Drebbil; though for a good many years it was regarded as little more than a scientific toy.

Towards the end of the 17th century there occurred in England, as elsewhere, a great awakening of scientific interest. A number of so-called "inquisitive persons" formed themselves into a society for the investigation of natural phenomena; the King, Charles II., who took considerable interest in scientific questions, became their patron, and thus, in 1662, the Royal Society was founded, Lord Viscount Brouncker, one of the most distinguished men in England, being appointed President. Other officers and Fellows were elected to the number of 145.

One of the members nominated to an official post was Robert Hooke, who was made Curator of Experiments to the Society. This remarkable man, who did so much pioneer scientific work in this country, was then 27 years of age. He was born at Freshwater, in the Isle of Wight, in 1635, seven years before the

birth of Newton. He was not only a keen observer, but a man of great inventive power, and he turned his attention very soon to the microscope, which he so much improved that, under his hands, it became a tool of real scientific value.

Hooke has described, in great detail, the way in which he fitted up his own instruments. For the making of his magnifying glasses he took a piece of fine Venice glass, and melted it in the flame of a lamp, drawing it out to a slender thread. He then re-heated the end of the thread, causing it to melt again, and form a globule of clear glass. He fastened a number of these globules with wax on a metal plate, with the thread uppermost, and ground them down on a whetstone, afterwards smoothing and polishing the surface with Tripoli powder. One of these minute globules was then fixed in a pin-hole pricked in a plate of brass or lead, and this simple glass was found to give a very large magnification. It had, however, to be held so near the object that it proved rather troublesome to use. The microscope that Hooke invented later and habitually employed was provided with two glasses, an object-glass and an eye-piece. They were fitted to each end of a brass tube, about seven inches long, and it could be drawn out to a greater length if required. This microscope was only used for opaque objects with surface illumination, but the delighted inventor tells us that it magnified a thousand thousand times--a very pardonable exaggeration of enthusiasm!

The first results of Hooke's observations were presented to the Royal Society in 1677, under the title *Micrographia, or some Physiological Descriptions of Minute Bodies made by Magnifying Glasses, with Observations and Inquiries Thereupon.* The bodies he examined were very varied. The days of specialization were as yet in the far future, and there was much for an "inquisitive person" to look at.

His first recorded observation was on the point of a needle; then the edge of a razor was examined, and the result noted down. A piece of finest lawn was made to appear as a "goodly piece of coarse matting," &c.

The earliest purely botanical investigations were made, oddly enough, on a piece of charcoal, which, he was much interested to find, had a porous, cell-like structure. He found the same appearance in cork, and this was the first discovery and announcement of the cellular structure of plants, which forms the basis of all our knowledge of plant anatomy.

It is not surprising that, among other *Minute Bodies*, moulds and other microfungi should have attracted his attention; and an early chapter of his great work deals with *Plants Growing in the Blighted or Yellow Specks of Damask-rose Leaves.* He had noticed in the months of June, July, and August that when

the rose leaves began to fade there appeared on the upper surface a number of yellow spots, and that on the corresponding under part of the leaf there were to be found little "yellow hillocks of a gummous substance," and in the middle of the hillocks minute black points. The microscope was called into requisition, and the black bodies were found to be made up of a multitude of little "cases like seed-cods," each on a single, transparent, straw-coloured stem. He compares them in appearance like to the fruit of the moss, "but that they were abundantly less." Hooke gathered and examined them for several seasons in succession, and pondered much on the question as to whether they were plants, or the eggs of some very small insects. He finally decided that they must be plants, for the shrewd reason that he could detect in them various stages of growth. His microscope could not show him that these "seed-cods" had a further claim to be considered by him as plants, in that they were cellular; he thought they were hollow, and might contain minute seeds. His drawing, though it shows no trace of septation in these spores, is a faithful representation, and is the first published enlarged drawing of a microfungus. It is, indeed, as Hooke says, "a very pretty object for the microscope." No name was given to it then, but a hundred years later Link, a German botanist, placed such plants in the genus *Phragmidium*, one of the many kinds of rusts.

Hooke was much exercised over the generation of his plant, trying to account for its continual reappearance and for its connection with the rose-leaves. He concluded that it was, in part at least, ascribable to a kind of mildew or blight. He had a theory that as the higher plants decayed, their substance degenerated and gave rise to a vegetable of a less "compounded nature." He also thought it quite possible that even these minute plants might be propagated by their own seed.

Micrographia contains still another chapter devoted to microfungi, entitled *Of Blue Mould and of the First Principles of Vegetation Arising from Putrefaction.* The mould which he describes and figures grew, he tells us, "on the sheep-skin binding of a small book," and is undoubtedly one of the *Mucor* family of moulds, though the term "blue mould" usually now signifies *Penicillium*, or *Eurotium*. His observations and deductions were again wonderfully accurate. He found that these small plants were "much like the substance of the softer kind of common white mushroom." He noted the tender stalks and the round knobs at the tips; but there his microscope again failed, and he could not determine if they were "knobs and flowers or seed cases." He returns to his speculations on the origin of the lower plants, and rather inclines to the theory of spontaneous generation for all fungi. He gives several in-

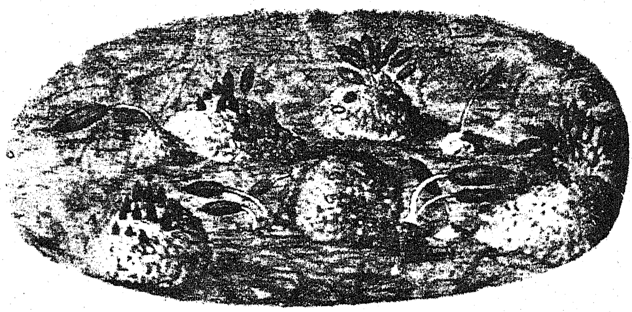

Fig. 1.

Fig. 2.

Fig. 1. Fungus on Rose leaf — Fig. 2. Fungus from Sheepskin cover of book.
Reproduced from Hooke's Micrographia, Observ. XIX. Scheme XII.

stances of mushrooms generating without seed, his theory being that fungi seem to depend merely upon a "convenient constitution of the matter out of which they are made," and a "concurrence of either natural or artificial heat."

Malpighi, an Italian physician and a keen worker in various branches of science, was a contemporary of Hooke. In 1686 he published his collected works, and one of the chapters is concerned with *Plantis quae in aliis vegetant.* Among these is included *Mucedo,* a plant which was, he tells us, obscure because of its small size, but which, nevertheless, he had observed with his optical instruments growing wild on decaying cucumber. He also publishes a figure of the mould, then, like Hooke, he plunges into speculation on the nature of the growth of these plants.

The next record of observations on microfungi falls to a British Botanist. In 1706 Ray published his *Historia Plantarum.* He enumerates the fungi known to him in his second genus of "*Plantae imperfectae,*" and there we find at least one quite recognisable microfungus, *Pilobolus crystallinus,* "*fungus ex stercore equino capillaceus, capitulo rorido, nigro punctulo in summitate notato.*" It had been observed in the neighbourhood of London by Petiver, and was figured by Plukenet in the *Phytographia,* which was issued in 1720. Plukenet, like so many Botanists of those and of later days, was a physician. He practised in London, and was certainly "attached to the study of Botany." Petiver also wrote on Natural History subjects. He was resident for some time in the East, and published a book on East India plants.

Some years passed before any other "inquisitive person" gave any serious attention to microfungi. Then in 1729 Micheli, Director of the Botanic Gardens in Florence, published his *Nova Plantarum genera,* many of them fungi of the smaller kind, recorded under the names *Botrytis, Aspergillus, Mucor, Lycogala,* &c. He had joined experiment to observation, and proved the nature of their generation by sowing the spores and reproducing the plant. He describes how he took the capitula of *Mucor,* and placed them on a suitable matrix, and how in a few days there appeared a woolly-looking white growth an inch in height, and finally the black heads of the *Mucor.* He applied the same experimental tests to *Botrytis* spores, sowing them on slices of pear, with equally satisfactory results. We may now consider microfungi as well established members of the vegetable kingdom. Linnaeus followed with his *Species Plantarum* in 1753, adding both genera and species to those already known.

The latter half of the 18th century was a time of considerable botanical activity in England. In 1762 appeared Hudson's *Flora Anglica,* which contains a fairly large record of fungi,

among them a number of so-called *mucors—cotten mucor*, *yellowish mucor*, *glaucus* or *greenish mucor*, and *crustaceus*, the *fingered mucor*. The two latter are the very common moulds, *Aspergillus* and *Penicillium*, which turn up in all lists. Hudson was an apothecary in London, whither he had migrated from Kendal, in Westmoreland.

Lightfoot broke new ground with his Scottish Flora, published in 1777. He describes a small *Sphaeria*, which he calls *Lycoperdon nigrum*, and he tells us "We had strong suspicions that those spherules might be of animal nature, but from what observations and experiments we have hitherto made, we are induced to think them rather of the vegetable kind." We only wish that Lightfoot had given us some more information about these experiments.

Richard Relhan comes next in our chronicle. He was born in Dublin, but was educated in England. His *Flora Cantabrigensis* is dated 1785, and includes a few of our plants with some mycetozoa. About ten years later Withering's third edition of the "*Arrangement of British Plants*" was brought out, and the fourth volume on *Cryptogamic Plants* marks a great advance in the general knowledge of the subject. He records a long series of forms observed by him and others in this country, classifying them under *Lycoperdon*, *Reticularia*, *Sphaeria*, *Trichia* and *Mucor*. Dickson in his *Cryptogamic Plants of Britain* (1785 to 1801) and Bolton in his *Fungusses of Halifax* both include a few species of microfungi, but they did not add much to the knowledge of these minute forms. The Flora Britannica of Dr. John Hill (1796) also contains a few examples.

In 1791 had appeared a most notable contribution to Mycology: Bulliard's *Champignons de France*—one of the great classics of botanical science. The drawings are accurate, and are especially rich in the smaller kinds of *Pezizae*, *Pyrenomycetes*, *Mucorini*, and *Mycetozoa*. The names have changed, but in many cases the plants can be easily identified. Bulliard died in Paris in 1793 at the early age of 51 years. It is delightful to think of him during those stormy years, quietly collecting his fungi and preparing his beautiful plates. One is apt to imagine that everyone was then living in a whirl of political excitement. Other contributions from the Continent we owe to Batsch, Tode, and Persoon, who were all working and publishing in the end of the 18th and the beginning of the 19th century, and microfungi now bulk largely in all the fungus floras. Fries from 1814 onwards, Kunze in 1817, Ehrenberg in 1820, and Link in 1824 brought out further important works, the number of genera and species recognised and classified increasing with each successive list.

To turn again to home workers, we find that our countrymen

are no laggards. James Sowerby began his English Botany in 1790, finishing in 1814; the companion work, "*Coloured Figures of English Fungi*," was begun in 1797, and the last of the 440 plates was issued in 1815. The text of the work was by Sowerby himself, and in connection with its production he made the series of more than 200 models of British Fungi now exhibited in the British Museum. Robert Kaye Greville's "*Scottish Cryptogamic Flora*" is equally worthy of praise. The publication was begun in 1823 in monthly parts; it was dedicated to Hooker, and was intended to serve as a continuation of English Botany, especially with reference to the Fungi. Neither of these writers can be accused of neglecting microscopic forms.

As we come down to our own day we find Berkeley doing a world's work for Mycology, and, along with him or following in his steps, Broome, Currey, Phillips, Cooke, Plowright, Massee, all doing yeoman's service for this group of fungi. I hope our late President, Mr. Lister, will allow us to annex, or rather to retain, the mycetozoa, and so add his name to our roll of honour.

As to future work, the yearly records of our Society show sufficiently that the knowledge of our fungus flora is far from being complete; there is ample scope yet for the collector and systematist. Besides this aspect of the subject, an immense amount of work remains to be done in linking up the different forms, in finding the affinities between the *Fungi imperfecti* and their further stages of development, and in tracing the life histories of the *Uredineae*. Dr. Plowright was one of the pioneers and most successful workers in this field, and I do not think anyone in this country has continued his work. It is a branch of research requiring much patience and careful observation rather than elaborate apparatus, and should very specially appeal to our country members.

In recent years the subject of plant pathology has attracted a great deal of attention. Rusts and mildews, rottings of root and stem, spotting and disfiguring of leaves, abnormal developments or withering up of the tissues, have in many instances been traced to the hurtful action of parasitic fungi, and they belong very largely to the group we have been discussing. There is no fear that these insignificant micro-forms will be overlooked or neglected in the future: they have passed from academic to economic regions of enquiry, and accurate knowledge of their life histories and of their relations to the higher plants has become necessary to plant growers. I would like just to recall the important work done in this field by our late President, Prof. Marshall Ward, and by a member of our Society, Mr. E. S. Salmon. Their studies and discoveries of biologic forms in the *Uredineae* and *Erysipheae* have been

notable contributions to plant physiology and plant pathology. We must again express the feeling of loss to our Society and to mycological science in the death of so able and distinguished a worker as Marshall Ward. His example should stimulate us all to further effort.

I should be a poor exponent of microfungi if I did not dwell a little longer on the delights of this particular branch of Botany. A great attraction to the student is that the plants are so easily gathered and preserved, and they form, as Hooke observed, so long ago, such "pretty objects for the microscope." The more fragile moulds should be mounted, as microscopic preparations, while they are fresh and in good condition, and not too mature. *Uredineae*, *Pyrenomycetes*, and *Fungi Imperfecti*, or *Deuteromycetes*, can be laid aside and examined at leisure; if, in any instance, the spores should dry up, a drop of lactic acid, or of weak ammonia, will restore them to their original appearance, and they can then be measured and described almost as accurately as when they were fresh. They are to be found at all seasons, in the most unlooked-for conditions, and often in overwhelming abundance. I read lately a quaint series of spore statistics by an American writer named Cobb, who was trying to impress the planters in the Philippines with the danger of allowing parasitic fungi to multiply and spread. A single smutted head of oats, he told them, is large enough to contain ten million smut spores; twenty million spores of the peach leaf-curl fungus might grow on a single square inch of a diseased peach leaf. Even the largest spores are extremely minute, as we all know, and here again Cobb supplies us with comparisons: fifty spores of moderate size could move abreast through the eye of a needle, and fifty thousand could be comfortably arranged on the end of a pencil.

Lack of space and time have obliged me to omit all discussion of the development of our knowledge of the Biology and Physiology of the microfungi. It is a subject fraught with the deepest interest, and of immense botanical importance. I have chosen to confine my review to the systematic side of the subject, as that in which we are more immediately interested as a Society.

I conclude by quoting from an old writer, Batsch, whose *Elenchus Fungorum* appeared in 1783. His mind was dwelling more particularly on the larger fungi, but his remarks apply equally, as I am sure you will all admit, to the minute forms. He says in his preface:—"When all nature is in the sleep of winter, then we find the earth covered with these creatures, which also accompany the finest seasons of the year. And truly, as I myself can testify, they afford more pleasure to the collector than summer with all its wealth can give. These

children of nature, which rise from a formless jelly and invisible seed, are able, as they develop, to procure for sensitive hearts, as fully as the finest plants, that deep respect and heavenly contentment which the consideration of nature alone can give."

Finally, may I commend to you the suggestive and appropriate lines of R. L. Stevenson:

"The world is full of a number of things,
I think we should all be as happy as Kings."

SIX FATAL CASES OF POISONING BY AMANITA PHALLOIDES (VAILL.) FR. AT IPSWICH IN SEPTEMBER, 1907.

By C. B. Plowright, M.D.

On Friday, 13th September, 1907, a man, in company with his son, gathered about one and a half pounds of fungi, which were taken home, cooked with some broth, and eaten by himself and his family for their evening meal. The cooking they received was but partial; it may be said the fungi were warmed in the broth rather than completely cooked. The family consisted of nine persons—the father, S. F., aged 42 years; the mother, L. F., 44; the eldest son, C. F., 17; Laura, 16; Mabel, 13½; Ernest 11; Beatrice 9; Willie 5½; Alfred 3½. The eldest son did not like the fungi, and tasted but did not swallow any of them. Ernest (11) "only tasted" the food, as did Beatrice. The first to show symptoms was Willie (5½), who vomited at 2.30 or 3 a.m., about nine or ten hours after eating the fungi. At 7.30 a.m. the eldest son on waking up found the whole family vomiting. The usual symptoms, thirst, diarrhœa, abdominal pains, cramp, &c., were present. Alfred (3½) was the first to succumb at noon on the 16th (62 hours); he was followed by Willie (5½) at 3 p.m. (65 hours); the mother (42) after aborting followed at 5 p.m. (67 hours); then Mabel (13½) at 7 p.m. (69 hours); then the father (44) at 4.30 a.m. on the 17th (79 hours); and lastly Laura (16) at 10 a.m. (85 hours).

The post-mortem examinations of the mother and Mabel showed slight jaundice, extensive gastro-enteritis, congestion of the bases of both lungs, enlargement and fatty degeneration of the liver, congestion of the brain and spinal cord—the typical signs of phalline poisoning.

Through the kindness of Dr. A. C. Young, on Tuesday, 17th

September, I saw the sole surviving child, Beatrice (9), who only developed the symptoms on the 16th. She had a characteristic purpuric rash on her face and a faintly yellow skin. She recovered. One other person, a married daughter, who happened to call while the family were at their fatal meal, partook of a small portion. She went home, was subsequently taken ill, and prematurely confined, but recovered. The eldest son, who accompanied the father when he gathered the fungi, conducted the Police Officer Keeble, who had charge of the inquest, to the exact spot where they were gathered—a number of typical specimens of *Amanita phalloides*—which were shown to me. The identity of the fungus had previously been determined by Mr. F. Woollnough, the Curator of the Ipswich Museum. Cases of fungus poisoning in which the species of the fungus is known are so rare in this country that it is earnestly hoped a full account of the symptoms and post-mortem appearances will be published.

REVIEW OF COMMENTS ON "ILLUSTRATIONS OF BRITISH FUNGI," TRANSACTIONS 1906, p. 150.

By M. C. Cooke.

I am grateful to M. Boudier for his "rectifications and critical observations" on the plates of my "Illustrations of British Fungi." I have never laid claim to infallibility, of which, I presume, I must have been possessed had I succeeded in reproducing just twelve hundred figures of British Agaricini without the luxury of a few mistakes. I have known M. Boudier for many years, and have a great respect for his opinion and judgment, but I think that some of his strictures require a little further consideration, which I will endeavour to suggest.

1. *Amanita virosa* Fr. I never found but once, in company with my old friend, Mr. D. Stock, of Bungay, and on that occasion there were several specimens in a small wood. Possibly I selected the largest and finest specimen for illustration, and hence may have presented an unusually "robust" form. I never entertained the slightest doubt of its being the true species.

2. *Am. phalloides* Fr. We have been in the habit of regarding the citrine forms, as well as olive, as belonging to this species.

3. *Am. verna* Bull. I am not disposed to argue this point. Let every man be persuaded in his own mind, as I am in mine.

7. *Am. excelsa* Fr. Possibly too green. I should object rather to too much yellow in it.

8. *Am. strobiliformis* Fr. That I did not regard this as typical is proved by the subsequent issue of Plate 277. Is it not possible that this, which represents a veritable specimen found by Dr. Bull, more closely resembles the figures of *Amanita Emilii* Riel. figured in Bulletin de la Société Mycologique de France Tome XXIII., 1 fasc., pl. 1, 1907, which may possibly be only a dark form of *A. strobiliformis.*

10. *Am. aspera* Fr. I was never well satisfied with this plate, but could not meet with other specimens.

34. *Am. magnifica* Fr. Although I regarded this as representing the Ag. magnifica Fr., I always doubted whether it were not an aberrant form of *Am. rubescens*, which is strengthened by M. Boudier's opinion.

11. *Am. megalodactyla* Berk. The original of this plate was communicated by the Rev. M. J. Berkeley, and must therefore be accepted as the *Amanita megalodactyla* of Berkeley, whatever may be said in favour of its being only a small and slender form of *Lepiota lenticularis* Lasch.

35. *Am. adnata* W. G. S. As this drawing was communicated by Smith, it may be taken to represent his species. If *Amanitopsis adnata*, without a ring, is identical with *Amanita junquillea*, with a ring, then Amanitopsis is condemned as a genus. Admitting their identity, then *adnata*, published in 1872, has four years priority of *junquillea*, published in 1876.

15. *Lepiota naucina* Fr. What is *Psalliota cretacea* Fr.? Opinions differ.

5. *Lepiota cepæstipes* Sow. The yellow figures represent a variety often found growing in company with the more typical form. There is only the colour to separate them.

18 and 213. Of no importance.

33. I am disposed to regard as *Arm. caligata* Viv.

54. Cannot be maintained as *Trich. portentosum.*

167. *Trich. virgatum* Fr. Pileus too dark and innate lines too pronounced.

94. *Trich. lascivum* Fr. Reproduced from drawing received from Rev. M. J. Berkeley.

229 and 69. Probably rather too yellow.

263. Lower figs. *Trich. humile* var. *blandum.* These figures from drawings communicated by Rev. M. J. Berkeley to represent his variety *blandum.* Hence he is responsible if it is to be referred to anything else.

136. *Clitocybe gilva* Pers. The drawing from which this plate was executed was communicated by Rev. M. J. Berkeley.

127. *Clitocybe Sadleri* B. I always protested to the Rev. M. J. Berkeley that this was only a sterile form of *Hypholoma fasciculare*, but it was inserted in deference to him.

267. The original drawing was communicated by Rev. M. J. Berkeley, as the species was unknown to me.

227. *Pleurotus ulmarius* Fr. Certainly is too highly coloured.

196. *Pleurotus ostreatus*, var. *euosmus*, B. From the colour of the spores could scarcely be confounded with any other species, but this feature is not sufficiently indicated in the plate.

422. Lower figs. I am still of opinion that this is *Entoloma Cookei* of Richon.

313. The lower figs. were communicated by Rev. M. J. Berkeley as *Agaricus repandum* Bull., but with what notification cannot now be ascertained.

470. *Agaricus frumentaceus* Bull. What its position I care not to argue.

345. Plate merely a reproduction of Sowerby's pl. 303.

349. *Pholiota terrigena* Fr. Original drawing submitted to and acknowledged by Elias Fries.

362. *Pholiota pudica* Fr. Original drawing communicated by Rev. M. J. Berkeley as typical form of this species on Elder stumps, with a special commendation of its esculent qualities.

363. I cannot accept the determination of M. Boudier, as the species has been found several times, and eaten with satisfaction.

364. *Pholiota capistrata* Cooke. May possibly be referred to *Pholiota aegerita*.

365. This was repudiated by the late W. Phillips latterly, although the original drawing was from him, under the name of *Pholiota aegerita*.

370. Upper figs. *Pholiota tuberculosa* Schff. Drawing communicated by Miss Berkeley, doubtless with the consent of Rev. M. J. Berkeley.

354. I can say very little of this plate. The original drawing, with fresh specimens, was sent to Elias Fries, who returned them with the name of *Pholiota Cookei* Fries, and his own description of the species. I should scarcely doubt his capacity to distinguish it from *Flammula ochrochlora*.

The species of Inocybe commented upon I am not disposed to discuss.

431. I have seen numerous specimens of *Flammula sapinea* from all parts of the globe, but *none* corresponding with this plate.

511. Lower figures from drawing communicated by Rev. M. J. Berkeley.

521. Certainly a great similarity between this plate and 585,

Psalliota villatica. "Who shall decide when Doctors disagree?"

535. The lower figures communicated by the Rev. M. J. Berkeley, as *Ag. coronillus* Bull. are marked by myself on the plate as = *Agaricus melaspermus* Bull.

543. The much-disputed *storea* of this plate is better placed as *Stropharia cotonea* Quél, and after many years of dispute I am glad that the question should be settled at last.

566. *Hypholoma lachrymabundum* is another species which has occasioned much controversy here for many years. The figures represented on Plate 566 had the approval of M. J. B. as to name, which latterly I am disposed to doubt.

I certainly shall not discuss the strictures on species of *Cortinarius.* Possibly difference in locality, climate, and surroundings alter and modify colour in such genera as *Cortinarius* and *Russula.*

1,087. I may note that on this plate, called *R. rubra*, var. *sapida*, there is an acknowledgment upon the plate itself that it is synonymous with *Russula atropurpurea* Krombh.*

955. *Armillaria Jasonis* C. & M. I think that Mr. Massee is quite capable of defending his species from the charge of being only a luxuriant development of *Lepiota amianthina.*

FURTHER NOTES ON BRITISH CLAVARIAE.

By A. D. Cotton, F.L.S.

Although the past season was not a specially favourable one for fungi, the writer was enabled, through the kindness of members of the British Mycological Society, to examine a considerable number of specimens of *Clavaria.* Nothing is of greater value when undertaking a critical study of a group than the opportunity of examining fresh material; indeed, in such a genus as *Clavaria* it is essential. *Repeated* observation also is important, and members of the Society may be assured that all specimens forwarded are received with the greatest interest and appreciation.

Several plants came to hand to which no name could be given. Delay in naming plants may be partly accounted for as follows. A plant may appear to agree with a certain little-known species, the diagnosis of which is brief and vague. Before, however,

* See also "Handbook," 2 edition, p. 326.

that name is definitely assigned, and an attempt made to amplify or amend the description, it is often advisable to wait a few seasons in order to see whether another species may not be forthcoming which more nearly agrees with the original description. *C. Kunzei* may be cited as a case in point. Here at least two distinct species have been received, both of which can be included in the original description. In the case also of a supposed new species, before drawing up a diagnosis, it is safer to examine several plants, and not to rely on one or two individuals from a single gathering.

Amongst numerous specimens examined recently, attention may be drawn to the species mentioned below. The spore measurements given are taken from spores that have been shed in the form of a spore print, and not directly from the plant. By this method greater uniformity of measurement is secured.

1. *Clavaria luteoalba* Rea. Several correspondents forwarded specimens of this species, which was first detected and described by Carleton Rea in 1903. In the field its small size and apricot-yellow clubs, with the apex usually white, distinguish it from *C. inaequalis*. The flesh also is practically identical in colour with the exterior of the club, whereas in *C. inaequalis* the flesh is white. Should any further doubt exist, the smooth spores 6-7 × 3 μ will at once settle the question. On drying the plant rapidly loses the apricot hue, and finally becomes pale ochraceous, the stem usually retaining the colour longer than the club, and becoming twisted.

There is another species of *Clavaria* very similar to *C. luteoalba*, which in the field is exceedingly difficult to separate from it. This species is apparently an undescribed one. It has been received more than once, but not in a condition sufficiently satisfactory enough for drawing up a diagnosis. For the present it will suffice to say that the species in question differs from *C. luteoalba* by the absence of a white tip, by becoming deep orange on drying, and by the spores, which are subglobose with an oblique apiculus.

The white apex from which the plant derives its name is a peculiar feature. It is more marked in some cases than others, and may even be altogether absent. Mr. Rea remarks in a letter that the white colour is very obvious in the field, but seems to disappear on drying. It can, however, generally be revived by throwing it on water.

C. luteoalba is the plant referred to by the writer in the Transactions for last year (p. 165, note) as *C. helvola* Pers. On account of the smooth spores, some authorities have named it *C. inaequalis*, but a glance at the original figure of that species will show that such an argument cannot be maintained.

The full description is as follows:—

Clavaria luteoalba Rea, Trans. Brit. Myc. Soc., 1903, p. 66, Pl. 3, fig. B.

Clubs simple, isolated, or in 2's or 3's, apricot-yellow, with apex white, small 3-5 cm. high, very slender 1·5-3 mm. thick, cylindrical or slightly compressed, smooth, solid, usually attenuated, apex acute or obtuse. Stem not sharply marked, often becoming more distinct on drying. Flesh orange-yellow. Internal structure not pseudo-parenchymatous in transverse section, but composed of loosely packed longitudinally-running filaments, hyphae 5-6 μ diam., containing orange-coloured granules. Basidia small $25\text{-}30 \times 5\text{-}7$ μ, contents slightly granular, sterigmata 4, erect. Spores hyaline, smooth, ovoid, av. $6\text{-}7 \times 3$ μ ($6\text{-}8 \times 3\text{-}4$ μ), not apiculate. Smell none. Taste like tallow.

Hab. In short grass, mossy banks. Not uncommon. Specimens received from Lyme Regis (Miss G. Lister, 1904); Grassington (C. Crossland, 1907); Newport, Isle of Wight (J. F. Rayner, 1907); Falmouth (Miss A. Fry, 1907); collected by the writer at Haslemere (Foray, 1905); and Bexhill (1906 and 1907).

2. *Clavaria acuta* Sow. In 1803 Sowerby described and figured a white *Clavaria*, which he named *C. acuta*. He represented it as a somewhat delicate species, possessing simple clubs, with an acute apex and a well-marked stem. Up to the middle of last century the plant appears to have been well known under that name, but at the present time *C. acuta* is to many mycologists an unrecognized plant. This may perhaps be explained (i.) by the fact that the name "acuta" is not a particularly good one, inasmuch as the clubs are frequently obtuse; and (ii.) that the spore measurements given in recent works are incorrect. There is no doubt, however, as to the identity of Sowerby's plant; it is a good and recognizable species. A revised and enlarged description is therefore subjoined:—

C. acuta Sowerby Fungi. t. 333; Fr. Syst. Mycol., vol. i., p. 485; Berk. Outl., p. 283; Cooke Handb., n. 991; Fr. Hym. Eur., p. 679; Stev. Brit. Fungi, vol. ii., p. 301; Massee Brit. Fung. Flora, vol. i., p. 85.

Clubs simple, isolated, or in 2's or 3's, glistening white, medium sized 3-7 cm. high, slender 2-3 mm. thick, cylindrical or compressed, smooth, becoming hollow, very brittle, attenuated, apex acute or obtuse. Stem usually very distinct, 1-2 cm. long. Internal structure pseudo-parenchymatous in transverse section, cells av. 10 μ diam. Basidia small $30\text{-}35 \times 7\text{-}8$ μ, conspicuous, contents granular, sterigmata 4. Spores hyaline, smooth, guttulate then granular, subglobose, av. $8\text{-}9 \times 7\text{-}8$ μ ($7\text{-}10 \times 6\text{-}9$ μ), minutely apiculate. Smell none. Taste pleasant.

Hab. In short grass in woods, shady lawns, flower-pots in greenhouses.

Specimens received from Huddersfield (C. Clarke, 1904); Grassington (C. Crossland, 1907); collected by the writer at Whitby (Foray, 1904); Botanic Gardens Kew, Arboretum and Greenhouses (1906 and 1907).

Plants of *C. acuta* have probably often been referred to *C. fragilis*, a species which, as shown below, has been misunderstood. From *C. vermiculata*, Scop., the common white species, *C acuta* may be readily distinguished by (1) its very distinct stem, (2) its habit of growth (not tufted), and (3) its large spores.

The frequent occurrence of *C acuta* in greenhouses has been noted by several writers. Schroeter, for instance, states (Kryptogamen-Flora von Schlesien, vol. iii., p. 444) that in the Breslau Botanic Gardens it regularly occurs in certain large pots, producing crops which continue for several weeks. At Kew the plant behaves in a similar manner. Presumably, the mycelium is introduced with the turfy-loam employed in potting.

It is quite possible that the plant described by Persoon (1797) as *C. falcata* (a name kept up in Continental works) is the same species as *C. acuta.* Persoon's description is, however, hardly sufficient to justify the adoption of his name.

3. *Clavaria fragilis* Holmsk. This species must be regarded as a synonym of *C. vermiculata* Scop. (= *C. vermicularis* Fr.), and may therefore be deleted from our books. The name *C. fragilis*, which was originally given by Holmskiold (Beata Ruris Otia, Descriptio Clavariarum, p. 7), has always been a subject of perplexity. A careful consideration of Holmskiold's figure and description can, however, leave no doubt that the principal plant that he had before him was *C. vermiculata*, though he doubtless included others with it. In his first figure, "*C. fragilis a*" the tufted plant on the right is evidently *C. vermiculata*, whilst those on the left probably represent slender forms of *C. rugosa*. *C. fragilis*, though an excellent name for *C. vermiculata*, cannot be adopted, as, according to rules of nomenclature, the latter name, having been published by Scopoli 27 years previously, has priority.

Considerable confusion existed as to the two names in older works, where they occur either united or separated. Modern authors have usually followed Fries, who kept up both names, though he added (Syst. Mycol., vol. i., p. 484) "an distincta." * In 1885 Schroeter (Kryptomagen-Flora von Schlesien, p. 445) broke away from tradition, and united *C. fragilis* with *C.*

*Fries (Hym. Eur. p. 675) also altered Scopoli's name—*C. vermiculata* to *C. vermicularis*. The latter is more accurate, but this cannot be regarded as a sufficient reason for abandoning the original name.

vermiculata. This, as shown above, is the only satisfactory course to pursue, though unfortunately Schroeter adopted Holmskiold's name instead of Scopoli's.

4. *Clavaria gigaspora* Cotton. Discovered by Mr. Crossland in November, 1906, this very distinct species was published by the writer under the above name in "The Naturalist" (March, 1907, p. 97). The description is as follows:—

Branched, caespitose, but distinct at the base, or isolated, greyish, with a tinge of yellow, small up to 3 cm. high, flesh tough. Branching irregular, sometimes almost palmate. Branches erect, occasionally forked, often wrinkled, solid, terete or compressed, much compressed at the acute axils, ultimate branches attenuated, apices blunt. Stem hardly distinct, about 1 cm. long. Internal structure not pseudo-parenchymatous in transverse section, but composed of densely-packed hyphae 4-4·5 μ diam., forming a firm, tough tissue, horny when dry. Basidia large 60-70 $\times$ 15 μ, contents granular, sterigmata 4, stout, 8-10 μ long. Spores hyaline, smooth, broadly elliptical, guttulate then granular, slightly oblique, av. 12-16 $\times$ 8 μ, very variable (10-20 $\times$ 7-9 μ). Smell none. Taste none.

Hab. Amongst moss on rocky heathy slope. A small dingy yellowish white plant, scarcely overtopping the moss in which it grows. In appearance it somewhat resembles certain forms of *C. cinerea* and *C. cristata*, but is readily distinguished from either by the large spores. The structure is also somewhat exceptional, being composed of very fine, densely-matted hyphae, which give rise to unusually large basidia.

5. *Clavaria rufa* Flora Danica t. 775, fig. 1; Stev. Brit. Fung., vol. ii., p. 296; Massee Brit. Fung. Flora, vol. 1, p. 82.

C. rufa is likewise a name that can be omitted from our books. The species is based on a coloured drawing in Flora Danica (1778), named "Clavaria polymorpha rufa." This was taken up by Persoon, who in his Commentatio furnished a diagnosis, and named it *C. rufa.* Fries included Persoon's name in his Syst. Mycol., and also in his Epicrisis, in which he remarks after quoting the Danish locality, "dein a nullo lecta, hinc dubia." Having been recorded from Scotland, the name occurs in British works, but in the floras of most other countries it is absent. On referring to the original figure, there is no doubt that it represents an orange and distorted form of *C. inaequalis.* A precisely similar specimen has been recently observed, which proved both in texture and microscopic characters to be in perfect agreement with this well-known species. *C. rufa* may therefore disappear, together with the numerous other synonyms of *C. inaequalis.*

FUNGUS NOTES FOR 1907.

By M. C. Cooke.

Although the records for this year are not numerous or important, one or two notes may be advisable on the larger species, leaving the microscopical to be dealt with elsewhere.

Lepiota serena Fries. (Sacc., Syll. I., 167). Clear white, pileus rather fleshy, campanulate then plane, naked, even smooth; stem stuffed, then fistulose, rather inclined to be bulbous, elongated, ring median entire, gills free, slightly ventricose.

In grassy places. Carlisle (Miss Decima Graham). This is the first time that we have been conscious of the appearance of this species in Britain. True it is that M. Boudier refers our figure of Armillaria subcavus (Pl. 46) to this species, but that is simply a speculation, on account of the external resemblance of the two species.

Clitocybe gilva Pers. Cooke, Hdbk., II., No. 169. This species has also been sent to us from Carlisle, and we take this opportunity to remark that the specimens received were much larger and more robust in the stem than those figured (" Illus.," pl. 136), but the feature to which we most desire to direct attention is that of the extreme smallness of the nearly globose spores, which in these specimens did not exceed 4 μ in diameter.

NEW AND RARE BRITISH FUNGI.

By Annie Lorrain Smith, F.L.S., and Carleton Rea, B.C.L., M.A., &c.

With plates 1, 2 & 3.

Entyloma Henningsianum Syd. in Hedwigia, p. 123 (1900).

Sori in scattered orbicular spots, 4-8 mm. in diameter, flattened, pale yellow, becoming brownish; spores globose or globose-angular, rarely ovoid, yellowish-hyaline, sometimes catenulate, with granular contents, then with a large nucleus, 10-15 μ, up to 18 $\times$ 12 μ, smooth, the epispore about 2 μ thick.

On living leaves of *Samolus Valerandi*, Dubh Loch, Inverary, Argyllshire. Collected by Mr. D. A. Boyd, September, 1907.

Botryosporium pulchrum Corda.

Beautiful specimens of this white mould were found in Alnwich Park during the Autumn Foray over-running decaying vegetation, with a delicate frost-like coating. It consists of a creeping mycelium, with upright conidiophores about $\frac{1}{4}$ inch in height. The main axis gives rise to a succession of secondary branchlets in acropetal succession, which are short, and divide near their tips to form four or five semi-globose heads, on which are borne the elongate-fusiform conidia, resembling strongly the heads of *Botrytis* conidia. They have always been described as 4-5-spicate, but that appearance is due to the shrivelling of the globose heads after the conidia are shed. Pl. 1, figs. 1 a-d.

Clonostachys Simmonsii Massee, in Kew Bull. No. 6 (1907), p. 242, figs. 9 and 10.

On dung of caterpillar of Swallow-tail moth. *Europteryx sambucaria* L.

Differs from *C. Araucaria* in the longer fertile spikes and in the larger spinulose conidia, $6 \times 4\ \mu$.

Ramularia necator Massee, l. c., p. 243, figs. 7 and 8.

On the cotyledons of seedlings of *Theobroma Cacao*, in the propagating pits, Kew Gardens. Seeds were brought from Jamaica.

Milowia amethystina Massee, l.c., figs. 3 and 4.

On damp decorticated wood, Herbarium grounds, Kew. G. Nicholson. The pustules are of a clear amethyst colour when moist and growing, becoming pallid when dry.

Hormodendron Bon., in Handb. allgem. Myk., p. 76 (1851).

Sterile hyphae creeping, branched, septate. Conidiophores upright septate, brown, variously branched or almost unbranched. Conidia in chains at the tips of the branches, globose or ovate, olive-green or brown, one-celled.

H. hordei Bruhne, in Zopf. Beiträge IV. 1 t. 1 (1894).

Tufts scattered over the leaf or confluent, brown, elongate. Conidiophores simple, septate, conidia cylindrical or fusiform, elliptical or almost globose, becoming septate, warted.
On living leaves of barley.

Var. *parvispora* A. L. Sm.

Sterile hyphae brown, creeping; fertile erect, septate, simple, about 200 μ in height, warted, bearing at the apices a head of

oblong, simple, short, catenulate or primary conidia 6-10 × 3-4 μ, which terminate in chains of minute brown cuboid-globose warted conidia, 4 × 3 μ. Pl. 1, fig. 2 a and b.

On damp wall paper, Southampton. Leg. J. F. Rayner.

Like the type, this fungus strongly resembles a *Cladosporium.* The primary conidia are only rarely septate, and the whole fertile part is minutely warted.

Torula spongicola Duf., in Bull. Soc. Vaud. Sci. Nat. XVIII., p. 144-47; Rev. Myc. V., p. 266 (1883).

Tufts effuse, black; conidia globose or subovoid 4-7 μ in diameter; at first subhyaline, then with a thick brownish-black epispore, nucleate or guttulate.

In the horny fibrils of a bath-sponge, Chelsea.

This fungus was reported first in France, then later was found also on sponges at Livorno and Padua. It changes the outstanding fibrils of the sponge to a purple-black colour. The sponge examined had been in use for some time, but always in water without soap.

Gonatorrhodiella Thaxt., in Bot. Gaz. XVI., p. 202 (1891).

Hyphae creeping, septate, branched. Conidiophores simple or branched, upright, with few septa, with intercalary or terminal swollen cells, beset with minute sterigmata, which bear the hyaline catenulate conidia, the whole forming a compact head.

G. Highlei A. L. Sm. sp. nov.

Hyphae steriles, repentes, pallidae; hyphis fertilibus circa 500 μ, alt. et 12 μ crass., subflavis; vesiculis paene sphaericis vel elongatis, 20-30 μ crass.; conidiis ellipsoideis vel sphaericis, flavis, levibus, singulis vel in catenulis brevibus, simplicibus vel ramosis 12-15 × 10-12 μ. Pl. 1, fig. 3 a, b, c, and d.

Hab. in Caeparum bulbis, London.

Haplographium finitimum (Preuss) Sacc. Syll. Fung. IV., p 307 (1886).

Tufts scattered, thin, blackish-olive; conidiophores erect, septate, the lower part intensely blackish-brown, becoming lighter in colour upwards, geniculate, branched, the branches sub-verticillate, non-septate, bearing chains of conidia; conidia globose, hyaline. Pl. 1, fig. 4 a and b.

On leaves of firs. In a wood, Halfmorton, Dumfriesshire, August, 1903.

The secondary branchlets forming the head are about 10 μ in height, and are of a slightly greenish tint; the spores are very minute and somewhat oval, about 3 × 1·5 μ. The main axis

continues to grow, and pushes aside the sporiferous head. Fr. v. Höhnel in Sitz. K. K. Akad. Wiss, Wien. Math. Nat. Kl. CXV., pp. 649-95 (1906), passes a number of forms under review, and in his paper he unites *H. flexuosum*, *H. fuscipes*, and *H. penicilloides* under the above species *H finitimum*.

Spondylocladium xylogenum A. L. Sm. sp. nov.

Hyphis sterilibus repentibus, fere hyalinis; Hyphis fertilibus erectis, plerumque simplicibus, vel raro ad basim furcatis, septatis, olivaceo-brunneis, ad apicem subhyalinis; circa 150 μ longis; conidiis ex hyphis verticillatim ortis, sessilibus, brunneis, opacis, subclavato-oblongis, 3 septatis, 15-25 × 8-11 μ. Pl. I, fig. 5 a and b.

In lignis vetustis. Shropshire. Leg. W. B. Allen.

S. atrovirens Harz. Hyph., p. 42, t. ii., f. 6 (1872).

Gregarious, effuse, blackish olive; hyphae erect, rigid septate, simple, 500 μ long, greenish black, rising from the creeping mycelium; conidia sessile 2-4, sessile in whorls from below the middle of the conidiophore, obclavate, acute at the apex, 5-6 septate, not constricted, minutely guttulate 60 μ long, greenish-black, opaque.

On potato, developed from the sclerotium of *Phellomyces sclerotiophorus*. Dublin, T. Johnson, Econ. Proc. Roy. Dublin Soc. I, pt. 9 (1907), p. 352, pl. XXXIII., fig. 2.

Stilbum sphaerocephalum Massee l. c., p. 243, figs. 13 and 14.

On wounds of living stem of *Philodendron*, growing in the Aroid House, Kew Gardens.

Most nearly allied to *S. connatum*, differing in the straw-coloured head, stem, and smaller spores. They measure 7 × 3 μ.

Exosporium laricinum Massee, in Kew Bull., No. 6 (1907), p. 242 figs. 15-18.

On young living larch branches, Queen's Cottage Gardens.

The minute black conidiophores occur in dense clusters at different points on the branch. Allied to *E. Tiliae*, but distinguished from this and every other known species by the fusiform conidia. They are 5-7 septate and measure 25-30 × 6-7 μ.

Phyllosticta bellunensis Mart, in Niov. Giorn. Bot. Ital. XX., p. 395 (1888).

Spots large, irregular, almost round, dark-coloured. Pycnidia punctiform, scattered over the spots, dark brown; spores rod-shaped, very small.

On fallen leaves of elm. Isle of Wight. Leg. J. F. Rayner.

The specimen collected by Mr. Rayner agrees with the above in the irregular character of the dark spots and the very minute rod-shaped spores, about 3-5 μ in length, 1 μ or so in width. The pycnidia are scattered or sometimes in close groups, and measure from 50 to 100 μ in diameter.

Cicinnobolus Ulicis Adams.

Pycnidia pedicellate, brownish black, 33·6-61·6 × 26·6-42 μ. Spores oval to oblong, one-celled, hyaline, 4·2-8·4 × 2·1-2·8 μ.

The species of this genus are parasitic on *Erysiphaceae*. This species was parasitic on one of these that was infesting the stems and leaves of *Ulex europaeus*.

On great Sugar Loaf. Co. Wicklow.

Irish Naturalist, XVI., 1907, pp. 168-9 (3 figs.).

Pyrenochaeta Phloxidis Massee Add. Fauna and Flora, Kew Gardens, in Kew Bull. No. 6 (1907), p. 241, figs. 1 and 2.

On stems of *Phlox* just above the ground line. This parasite quite destroyed a bed of Phlox; the foliage at first assumed a greenish-yellow, sickly tinge, and afterwards wilted and fell, followed by the breaking of the stem near the base. Most nearly allied to *P. ferox* Sacc.

Ascochyta Cookei Massee in Kew Bull. No. 6 (1907), p. 241, figs. 5 and 6.

On living leaves of Sweet William.

This species was collected in Kew Gardens by Dr. Cooke several years ago, and placed in the herbarium under the name of *Ascochyta Dianthi* Berk., presumably on account of a very close superficial resemblance between the two species; the spores, however, are different in size and shape; in *A. Dianthi* they are narrowly fusiform, and measure 14-16 × 4 μ. Those of *A. Cookei* are cylindrical-clavate, septate in the middle, and measure 40 × 4-5 μ.

Colletotrichum malvarum (A. Br. and Casp.), Southworth, Journ. Mycol. VI., p. 116 (1891).

Spots formed on the upper side of the leaves or on the stems, yellowish-brown, beset with upright, stiff, 1 or 2 septate brown, bristle-like filaments, 60-109 × 3-5 μ; spores elongate, colourless, cylindrical, blunt at the ends, 11-28 × 5 μ.

This fungus is recorded as *C. altheae*, causing a virulent disease of hollyocks in America, by Massee, in Diseases of Plants, p. 290. It has since been identified as synonymous with *Steirochaete malvarum*, and the author has recognised the iden-

tity in adopting the earlier specific name. The plant was received from Mr. D. A. Boyd, but was collected by Mr. Wishart at Alyth, Perthshire, on a malvaceous plant. We are not aware of any previous record in this country.

Melanconium Hederae Preuss., Fungi Hoyersw., No. 312, Sacc. Syll. Fung. III., p. 751.

Pustules scattered, lens-shaped, seated in the outer cortex, somewhat prominent, black, opening by a pore, sporophores filiform, spores ovate, brownish or olivaceous-black, smooth.

On branches of Ivy. Killin, Perthshire. Mr. D. A. Boyd. Previously reported by Mr. Boyd from Ayrshire.

Saccardo has suggested that this fungus may be the same as *Coniothyrium Hederae*, but the specimen examined is an undoubted *Melanconium*. The spores are rather small 6-8 × 3-4 μ. This seems to be the first British record for the species. *Coniothyrium Hederae* is reported from King's Cliffe.

Marssonia Delastrei Sacc. Mich, ii., p. 119 (1880).

Spots indeterminate, dirty-yellow, on both sides of the leaf; perithecia minute, yellowish, scarcely erumpent; conidia clavate-obpyriform, 20-25 × 6-7 μ, often unequal sided, 1-septate below the middle, hyaline; conidiophores short, round, 8-10 × 3 μ.

On leaves of *Lychnis* and *Silene*. Alnwick Park, Northumberland. October, 1907.

The somewhat large unequally 2-celled spores are a very characteristic feature of this fungus.

Lophodermium Oxycocci Karst. Mycol. Fenn, p. 244 (1871).

Apothecia small erumpent, scattered, elliptical, pointed at the ends, simple, rarely forked, black or blackish brown, with a central furrow; asci clavate, long-stalked, 70-90 × 6-8 μ, 8-spored; spores filiform, straight or somewhat bent, simple, colourless, up to 45 × 1·5-2 μ; paraphyses filiform, rather thick and bent at the tips.

On withering leaves of *Vaccinium Oxycoccos*. Found by Mr. D. A. Boyd in a bog near Kilwinning, Ayrshire. September, 1906.

Coccomyces Boydii A. L. Sm. sp. nov.

Sparsus, suborbicularis, subdepressus, innato-emergens et per corticem rotundatim dehiscentem emergens, disco pallido vel carneoflavido subnitido, 1-3 mm. lat.; Ascis cylindraceo-clavatis apice attenuatis, 90-115 × 8 μ, sporis filiformibus, multi-guttulatis, vel dubie multi-septatis, hyalinis, circa 50-55 × 1 μ;

paraphysibus numerosis, filiformibus, simplicibus, apicem versus flexuosis, quam ascis longioribus, omnino hyalinis 1·5-2 μ lat.

Ad corticem *Myricae Gales.* Killin, Perthshire. D. A. Boyd. July, 1907.

Very near to *C. triangularis* on *Quercus alba,* but besides the difference of host and of dehiscence, an examination of that species shows that the asci are less numerous as well as larger, about 12 μ in width, and the spores stouter; the paraphyses are conglutinate, and are also more slender than in the species on *Myrica.*

Pseudophacidium Karst., in Acta Soc. Faun. and Fl., Fenn II., p. 157 (1885).

Ascophores immersed, erumpent, causing a swelling, and then bursting the cortex, splitting at the disc in several teeth, leathery, blackish. Asci clavate, 8-spored, spores elongate, blunt, straight or somewhat bent, one-celled, colourless; paraphyses usually slender and colourless.

Peudophacidium Callunae Karst. l. c.

Apothecia gregarious, round or elliptical, bursting the cortex, blackish-brown, opening by 4 to 5 teeth or splitting, and exposing the greyish disc, 1 to 2 mm. in diameter. Asci clavate, blunt at the tips, long-stalked, 100-110 × 10-14 μ, 8-spored; spores oblong, blunt, straight or somewhat bent, one-celled, colourless, 12-18 × 3-6 μ; paraphyses slender and scarce.

On stems of heather. Dunkeld. Collected by Mr. C. McIntosh in February, 1907.

This species looks very like a pyrenomycete with the dark sheath covering the disc. The paraphyses are so few as to be practically non-existent.

Cudoniella Sacc. Syll. Fung. VIII., p. 41 (1889).

Ascophore stalked, hemispherical, concave below, the margin involute, somewhat waxy or fleshy. Asci clavate, 8-spored; spores fusiform, hyaline continuous, becoming pluri-septate or pseudo-septate.

Saccardo describes the contents of the spores as divided into 2-4 parts, and becoming 1-3-pseudo-septate. Boudier in his recent *Discomycetes D'Europe,* p. 89 (1907) limits the genus to 1-septate spores. The species described below agrees in all respects with *Cudoniella* except that the spores at maturity are pluri-septate.

Cudoniella Allenii A. L. Sm. sp. nov.

Sparsa vel subgregaria, minuta, circa 2 mm. alt. et 1·5-2 mm. lat. aeruginea; ascomate ceraceo, convexo, subtus concavo, levi;

stipite brevi externe subochraceo vel subaerugineo, interne hyalino-ochraceo; ascis oblongo-clavatis versus basim attenuatis 100 × 8 μ; sporidiis oblongis leniter curvatis, continuis dein pluri-plerumque 6-septatis vel pseudo-septatis 17 × 3 μ, subaerugineis dein hyalinis; paraphysibus filiformibus, ramosis, ad apicem minute globosis 2·5 μ diam.; disco et hymenio colore aerugineo suffuso. Pl. 1, fig. 10 a-d.

Ad ligna vetusta. Shropshire, Vere, 1907. Leg. W. B. Allen.

Meliola Fr. Elench. Fung. 11, p. 109 (1828).

Mycelium developed on leaves, more rarely on twigs, dark brown, often beset with round, lateral, one or more celled bodies (hyphopodia). Perithecia numerous, globose or ovate, often surrounded by setae; peridium carbonaceous, one-layered, without an ostiole; asci globose or ovate, rarely clavate or cylindrical; spores brown when mature, large, oblong, 2-4 septate.

M. Niessleana Wint in Hedwigia XXIV., p. 260 (1885).

Mycelium on both sides of the leaves, forming round or irregular spots, the hyphae densely intricate, creeping, branched, septate, dark brown; hyphopodia usually alternate, varying in form, stalked, 21-25 μ (with the stalk) × 14-17 μ; setae rising from the mycelium, rigid, erect, black, obtuse; perithecia superficial, globose, verrucose, black, 240-260 μ in diameter, surrounded by the rigid setae; asci oblong, thick, attenuate, 2-4-spored, 87-100 × 26-32 μ; spores elongate-oblong, somewhat attenuate and rounded at the ends, unequal or curved, 3-septate, dark brown, slightly constricted at the septa, 47-54 × 14-16 μ. Pl. 1, fig. 6 a, b, and c.

On living leaves of *Rhododendron*, &c.

This specimen was collected on living leaves of *Vaccinium Vitis-Idaea* by Mr. D. A. Boyd at Killin, in Perthshire, in July, 1907, but he had long been familiar with it in other parts of the country, and has collected specimens in Ayrshire. It agrees with the description of the above species, and has also the parasite *Nectria aureola* growing on it that was found by Winter in Salzburg. Mr. Boyd had detected the parasite before sending the specimens for determination.

Nectria aureola Wint. in Hedwigia XXIV., p. 261 (1885).

Perithecia gregarious, pale yellow, globose-conoid, rounded at the apex, beset above with short, rigid, simple, hyaline hairs; asci oblong-fusiform, with a short blunt stalk, 8-spored 47-53 × 7 μ; spores fusiform, attenuate and narrowly rounded at the ends, septate, colourless, 14 × 2.5 μ.

Parasitic on the mycelium of *Meliola Niessleana.*

Collected by Mr. D. A. Boyd at Killin, Perthshire, July, 1907.

Claviceps Junci Adams, Irish Nat. XVI., p. 168, fig. 1 (1907).

Sphacelia stage only was found, occurring in the ovary of *Juncus glaucus*, and filling up its interior with an immense number of colourless spores. The spores are oblong to elliptical in shape, one-celled, 7-10·3 × 2·8-3·5 μ. Obtained on 17th September, on Royal Canal bank, Co. Dublin.

Cucurbitaria pithyophila de Not. Sferiac. Ital., p. 60 (1863).

Stroma erumpent, variously formed; perithecia superficial on the stroma, crowded, at first globose with a wide open papilla, then becoming sunk and concave, about ·5 mm. in diameter; asci cylindrical, smaller towards the stalk, 8-spored, 115-140 × 10-11 μ; spores oblong, narrow at the ends, septate, constricted in the middle, with one longitudinal division, yellowish brown, 17-23 × 7-8 μ; paraphyses slender, branched.

On the bark of living or dead conifers. Dunkeld. Collected by Mr. C. McIntosh.

A careful examination of this specimen shows the spores to be 5-septate.

Sphaerella Polypodii Fuck. Symb., p. 102 (1869).

Perithecia semi-immersed, small, globose, dark brown, loosely scattered on somewhat large greyish-brown spots; asci subclavate-oblong, 8-spored, 47-52 μ long, 14 μ thick; spores oblong fusiform, becoming 1-septate, 17-19 μ long, 5-6 μ thick.

On living leaves of *Polypodium vulgare*, *Aspidium Filix mas*, *Pteris*, and *Asplenium Trichomanes*.

Collected on *A. Trichomanes* by Mr. D. A. Boyd, Inverary, Argyllshire, September, 1907.

The specimen agrees very closely with the description of the Plant given by Fuckel, except for the spores, in which the median septum has been queried. In Mr. Boyd's specimen the spores are distinctly septate.

Leptosphaeria vagabunda Sacc. Fungi Veneti Ser. ii., p. 318; *Sphaeria fuscella* Sacc. Mycol. Ven. 97, t. IX., figs. 37-46.

Perithecia seated in the cortex, covered by the epidermis, scattered or congregate globose, with small scarcely protruding ostioles, 200-500 mm. in diameter; asci clavate-cylindrical, shortly stalked, 8-spored; paraphyses filamentous; spores fusiform, constricted in the middle, at first colourless and 2-septate, becoming brown and 3-septate, slightly constricted at the septa, 19-26 × 6-7 μ. Pl. 1, fig. 7 a, b, and c; fig. 8 a and b.

On dead branches of various trees and shrubs. On *Ribes grossulariae*. C. Rea, Worcester, July, 1907. Annan, Dumfriesshire, August, 1907, A. Lorrain Smith, and at Alresford, Hants, October, 1907.

The specimens collected agree in most particulars with *L. vagabunda.* The spores are rather narrower, measuring only up to 6 μ in width. On the same host a specimen of *Coniothyrium* was collected in June, 1906, which was diagnosed to be *C. ribicolum* (Trans. 1906, p. 168). Saccardo gives *Coniothyrium vagabundum* Sacc. as the pycnidial form of this fungus, and on comparing the two species I find that they are very closely allied and probably identical. The spores of *C. vagabundum* are described as olivaceous, measuring $4 \times 1{\cdot}5$ μ. Those of *C. ribicolum* are sooty-brown, and measure $3\text{-}4 \times 2$ μ. The specimen from Worcester had spores rather larger than either of these, $4\text{-}6 \times 2$ μ. The infected gooseberry shoots collected at Annan had perithecia of both *Leptosphaeria* and *Coniothyrium* stages of the fungus growing together, and the spores of the latter measured $6\text{-}9 \times 2\text{-}4$ μ. In spite of these differences in size of the spores, I consider that we are dealing with but one species, *C. vagabundum.* The fungus is a troublesome pest of gooseberry bushes, as it lives on the young shoots, and either kills them or seriously impairs their vitality. The leaves fall early before the berries are mature.

Curreyella Lindau in Engl. and Prantl. Nat. Pflanzenf. i., abt. 1, p. 379 (1897).

Stróma dothideoid, hemispherical or disciform, black; asci elongate, 8-spored; spores elliptical or oblong, pluriseptate, muriform, colourless.

The genus differs from *Curreya* in the colourless spores; it was made a subgenus by Saccardo Syll. Fung. XI., 1895, p. 379, and raised to generic rank by Lindau. It is not to be confounded with Massee's genus *Curreyella* Fung. Flora IV., p. 401.

C. Aucupariae A. L. Sm. sp. nov.

Stromatibus ad corticem interiorem adnatis, erumpentibus, fusco-nigris, in magnitudine mutantibus, hemisphaericis vel elongatis, circa 1 mm. longis; peritheciis paucis, loculos 30-40 μ diam. formantibus; ascis clavatis usque ad 200×12 μ; sporidiis clavato-fusiformibus, 5-6 septatis, parceque muriformibus, hyalinis, $30\text{-}40 \times 8\text{-}10$ μ. Pl. 1, fig. 9 a and b.

Ad ramos *Pyri Aucupariae.* Dunkeld, Scotland. Leg. C. McIntosh. February, 1907.

This species comes very near to *Curreyella Rehmii,* which grows on branches of *Ribes.* It differs in the longer somewhat narrower spores and in the habitat.

Omphalia velutina Quél. As. fr. 1885, t. 12, f. 1, Fl. Myc., p. 202. See pl. 3 hereof.

Pileus 10-12 mm. wide, convex, umbilicate, striate, greyish or yellowish grey. Stem 10-15 mm. long, 1-2 mm. thick, *finely tomentose*, of the same colour as the pileus, but white from the mycelium at the base, solid. Flesh dark grey. Gills 1-2 mm. wide, distant, arcuate, yellowish grey. Spores ovoid pruniform, 10 × 6 μ, white, guttulate.

On the ground, Willey Park, Shropshire, 23rd September, 1907. Mr. W. B. Allen.

Easily distinguished from its allies by the tomentose stem.

Omphalia gracilis Quél. As. fr. 1880, t. 8, f. 2., Fr. Ic., t. 75, f. 5. Quél. Jur. I., t. 4, f 2., Fl. Myc., p. 196. See pl. 2 hereof.

Entirely snow-white. Pileus 3-8 mm. wide, membranaceous, campanulate, *papillate*, *striate*, *smooth*, transparent. Stem 20-30 mm. long, 1 mm. thick, delicately fistulose, filiform, transparent,, *pruinose*, *fibrillose at the base.* Gills 1 mm. wide, distant, very decurrent, thin. Spores white, 8 × 3-3·5 μ.

On dead grass leaves and stems. Swarraton Rectory, Hampshire, 28th and 30th October, 1907. Rev. W. L. W. Eyre.

Easily distinguished from *Omphalia gracillima* Weinm. by the translucent pruinose stem and the striate smooth pileus.

Inocybe duriuscula Rea. Vide tab. 3.

Pileus 6-7 cm. latus, carnosus e campanulato, expanso-gibbosus, floccosus, mox longitudinaliter fibrillosus, fulvo-ochraceus, centro expallente, margine demum revoluto. Caro crassa, alba, immutabilis, *duriuscula.* Stipes 8 cm. longus, 1·5 cm. crassus, solidus, apice et basi incrassatus, albus, striatus, firmus. Lamellae 6-8 mm. latae, subconfertae, ex albo fuscescentes, sinuato-adnatae *dente decurrente.* Sporae umbrinae, forte nodulosae 9-10 × 7-8 μ. Cistidia ventricosa, 52-60 × 13-15 μ, copiosa.

Locis herbidis ad terram in via sylvae. Monk Wood, Worcestershire, 20th September, 1907. C. R.

Easily distinguished amongst the larger Inocybes with cystidia and rough spores by its firm texture and the decurrent teeth of the gills forming ribs on the apex of the stem.

Inocybe proximella Karst. Symb. Myc. IX., p. 44; Sacc. Syll. V., p. 781; Mass. Monog. Inocybe, p. 466. See pl. 2 hereof.

Pileus 2-5 cm. broad, conico-convex, then expanded and umbonate, even, then longitudinally fibrously cracked, pallid, the disc and especially the umbo passing into rusty brown or bay. Stem 6-8 cm. long, 5-10 mm. thick, stuffed, slightly narrowed

upwards, usually ascending from the base, sometimes wavy, subfibrillose, pallid. Flesh white. Gills 6-7 mm. wide, pallid, then tan, finally brown, adnate, crowded *ventricose.* Spores *irregularly oblong, slightly nodulose,* 7-10 × 5-7 μ, rust colour. Cystidia ventricose 55-70 × 15-24 μ, abundant.

On the ground, Swarraton, Hampshire, 11th September, 1907. Rev. W. L. W. Eyre.

Easily distinguished from *Inocybe asterospora* Quél by the irregularly oblong nodulose spores and the ventricose gills.

Hypholoma peregrinum Massee, Kew Bull., No. 6, 1907, p. 239, fig. 19.

Gregarious on decaying wood in the Tropical Fern House, Kew Gardens.

Mr. Massee remarks that this is in all probability an introduced species, bearing some resemblance to *Hypholoma atrichum* Berk., from India, but differing in the narrow, very closely crowded gills, flattened (not umbonate) pileus, and smaller spores.

Add. to Wild Flora and Fauna of Kew Gardens, Kew, Bull., No. 6 (1907), p. 239.

Hygrophorus discoxanthus Rea. *Agaricus discoxanthus* Fr. Obs. Myc. I., p. 15 (1815), Secr., vol. II., p. 203 (1833); cfr. Fr. Monog. II., p. 124. See pl. 3 hereof.

Pileus 4-6 cm. wide, at first white, then yellowish, *deeper coloured at the centre,* and *the extreme margin becoming brownish with age,* viscid, convex, then expanded and revolute and depressed at the centre. Stem 3-4 cm. long, 6-12 mm. thick, gradually attenuated downwards, often curved, white, soon becoming *reddish brown,* white farinaceous at the apex, solid, viscid. Flesh white, becoming reddish in the stem. Gills 5 mm. wide, white, then yellowish, *edge turning reddish when bruised at first,* and then *finally reddish brown, especially towards the margin of the pileus,* somewhat distant, decurrent, veined at the base, exceeding the margin of the pileus. Smell *pleasant, like aniseed.* Spores white, pruniform, apiculate, one guttate, 6-7 × 4 μ.

Amongst grass, Alnwick Park, Northumberland, 1st October, 1907. Miss A. Lorrain Smith and Mrs. Carleton Rea.

Distinguished from its allies by the brownish margin of the pileus, the reddish-brown colour of the stem, both inside and out, the edge of the gills bruising red at first, and then finally becoming reddish brown, and the sweet scent of aniseed.

Craterellus pusillus Fr. Epic. 533, Syst. Myc. I., p. 321 ; Hym. Eur., p. 632. See pl. 2 hereof.

Pileus 10-12 mm. wide, convex, umbilicate, thin, rugose, *villous*, cinereous. Stem 5-20 mm. long, 2-4 mm. thick, stuffed, somewhat compressed, grey. Hymenium smooth or slightly wrinkled, pruinose, *bluish grey*. Spores white, ovoid or elliptical 8-10 × 6-7 μ, finely punctate.

On bare soil under Beeches, Swarraton, Hampshire, 20th August, 1907. Rev. W. L. W. Eyre.

Collybia veluticeps Rea. Trans. Brit. Myc. Soc. vol. I., p. 157.

It has lately been pointed out that this name was pre-occupied by an Australian species of C. & M. in Dr. M. C. Cooke's Handbook of Australian Fungi. It must consequently be replaced by *Collybia eriocephala* Rea.

DESCRIPTION OF FIGURES, PL. I.

1. *Botryosporium pulchrum* Corda, a. Conidiophore near tip of main branch × 550 ; b. almost mature with conidia × 550 ; c. shrivelled after the conidia are shed × 550 ; d. conidia × 550.

2. *Hormodendron Hordei* Bruhne, var. *parvispora* nov., a. Conidiophore × 550 ; b. conidia × 550.

3. *Gonatorrhodiella Highlei* sp. nov., a. Conidiophore × 110 ; b. tip with conidia × 275 ; c. conidium × 550 ; d. primary conidium with secondary conidia × 550.

4. *Haplographium finitimum* Sacc., a. tuft of conidiophores × 110 ; b. tip × 550.

5. *Spondylocladium xylogenum* sp. nov., a. Conidiophore × 550 ; b. mature conidium × 550.

6. *Meliola Niessleana* Wint., a. perithecium and hyphae × 18 ; b. hyphae with hyphopodia × 275 ; c. spore × 275.

7. *Leptosphaeria vagabunda* Sacc., a. shoot attacked by fungus, × 2 ; b. section of perithecium × 110 ; c. ascospore × 550.

8. *Coniothyrium vagabundum* Sacc., a. section of perithecium × 110 ; b. spores × 550.

9. *Curreyella Aucupariae* sp. nov., a. section through stroma and perithecium × 110 ; b. spores × 550.

10. *Cudoniella Allenii* sp. nov., a. Fungus on piece of decaying wood, nat. size ; b. slightly magnified ; c. ascus × 550 ; d. ascospores × 550, one of them germinating at each end.

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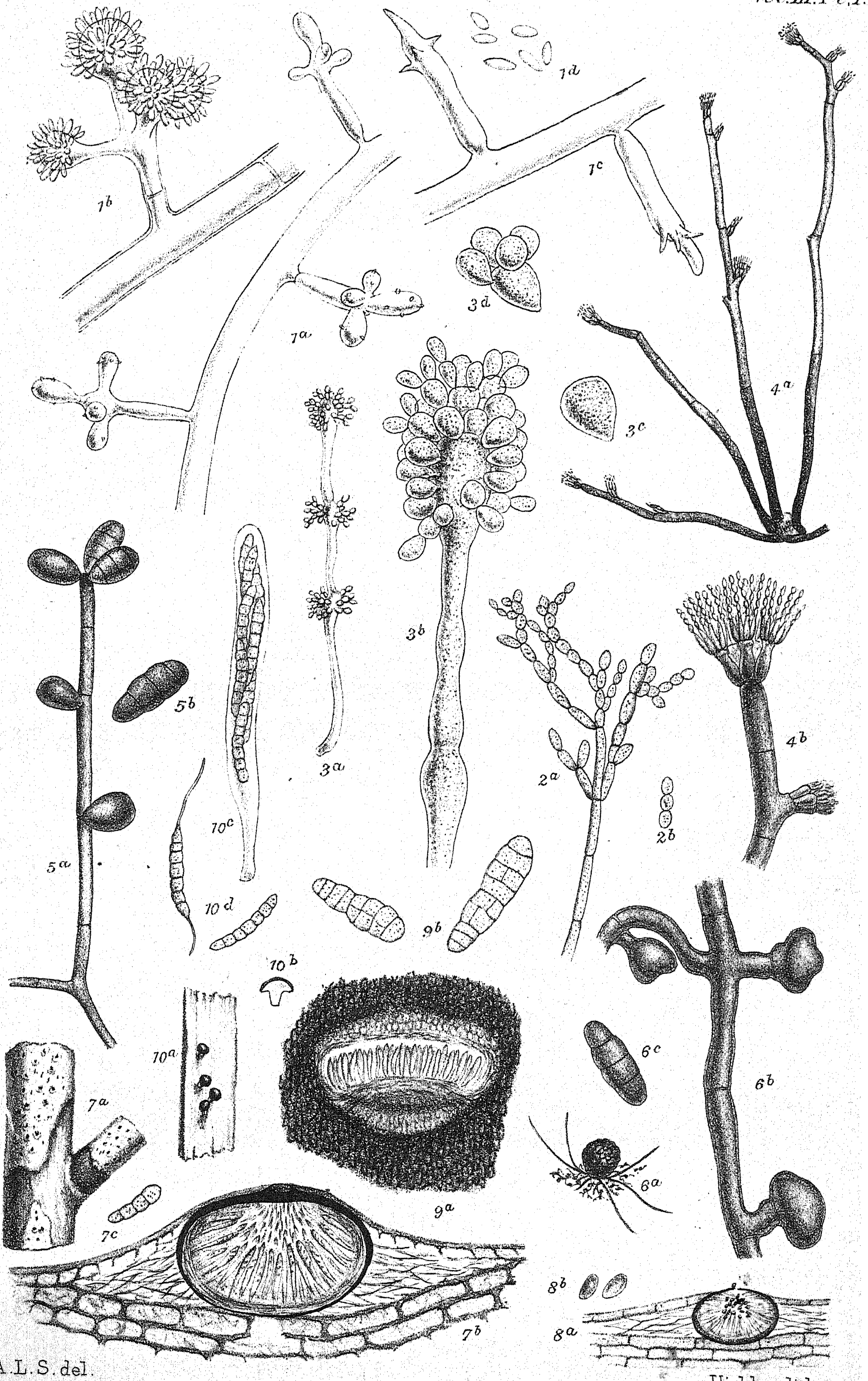
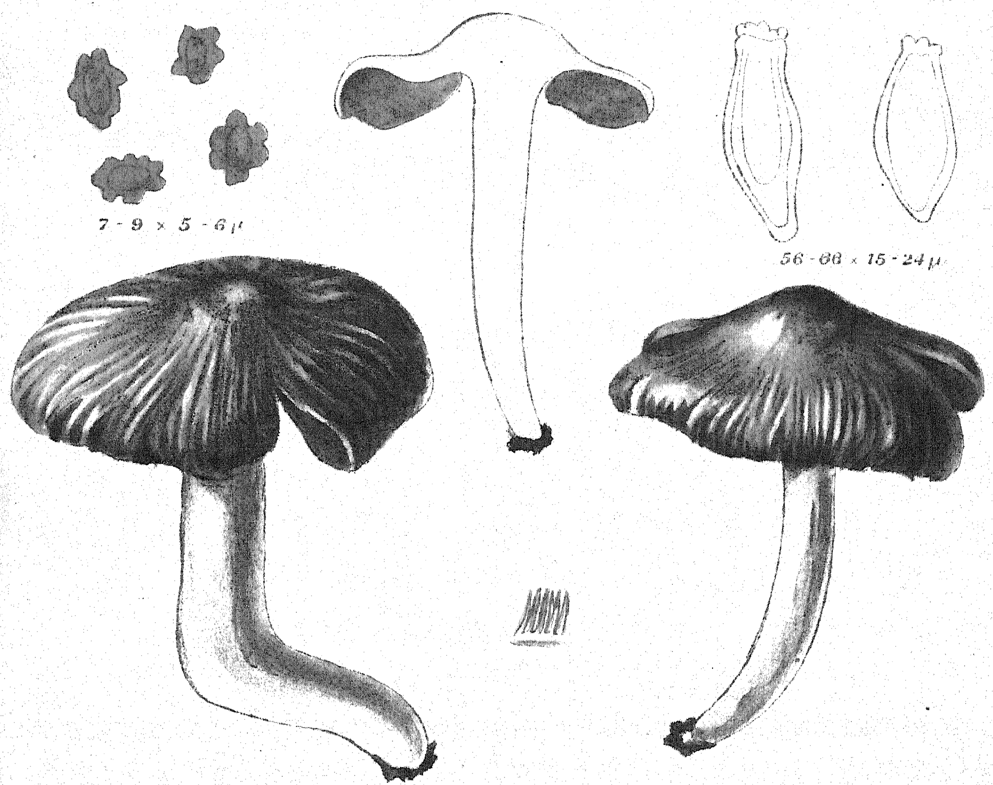
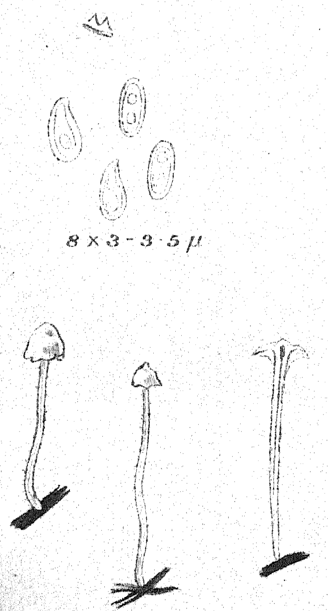
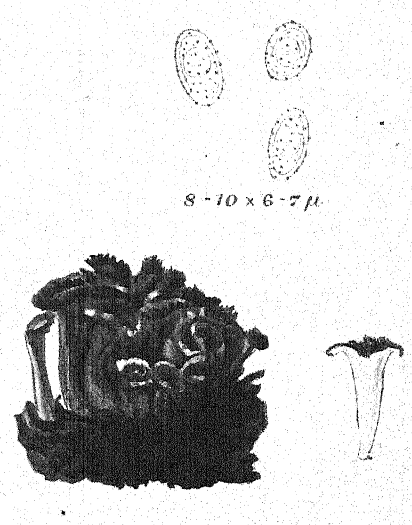


A.L.S. del. Highley lith.



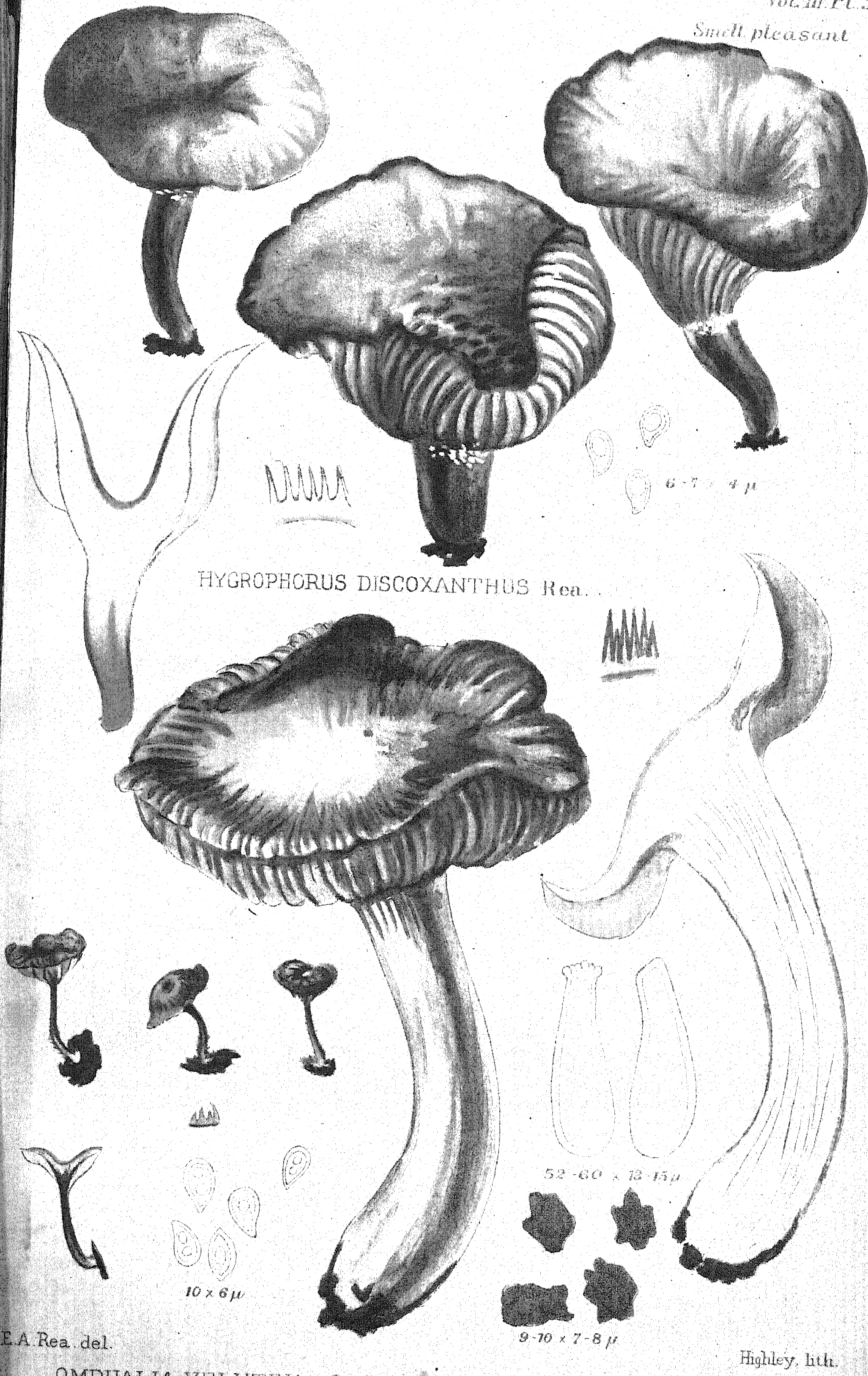
INOCYBE PROXIMELLA Karst.





E. A. Rea. del. Highley lith.

OMPHALIA GRACILIS Quél. CRATERELLUS PUSILLUS Fr.



E. A. Rea. del. Highley, lith.

OMPHALIA VELUTINA Quél. INOCYBE DURIUSCULA Rea.

THE DRUMNADROCHIT FORAY.

Joint Meeting with the Cryptogamic Society of Scotland.

14th to the 19th September, 1908.

The twelfth annual week's Fungus Foray of the British Mycological Society was held at Drumnadrochit on the Caledonian Canal, in conjunction with the Cryptogamic Society of Scotland, where the members of the two Societies assembled at the Drumnadrochit Hotel on Monday the 14th of September. A room in the village had been engaged for the exhibition of the specimens, but proved quite inadequate for their display. When the members resorted thither on their first evening they found that some enthusiastic mycologists had already secured specimens in the district. These were laid out on exhibition and were added to by others of interest brought to the meeting or sent for inspection. Mr. E. M. Holmes, F.L.S., contributed fine specimens of *Geaster Bryantii* Berk. from his garden at Sevenoaks, Kent. The Rev. W. L. W. Eyre sent *Amanita Vittadinii* Moretti, *Pluteus spilopus* B. & Br. and *Naucoria semiorbicularis* (Bull.) Fr. from Swarraton. Mr. W. B. Allen brought specimens, from the neighbourhood of Benthall, of *Paxillus panuoides* Fr., *Trametes rubescens* (A. & S.) Fr., *Inocybe Godeyi* Gillet, *Boletus parasiticus* Bull. and the terrible dusty potato disease *Chrysophlyctis endobiotica* Schilbersky. The President exhibited an extreme form of the somewhat rare *Kneiffia setigera* Fr. which he had found on his journey up at Craig Phadrick, near the starting point of the Caledonian Canal steamers from Inverness. Mr. Rupert Smith brought to the meeting a nice example of *Naucoria erinacea* Fr. Later on in the week, Mr. Spencer H. Bickham sent on for identification the somewhat rare *Geaster fornicatus* (Huds.) Fr., and Mr. Charles Crossland, F.L.S., sent a splendid gathering of the rare *Hypocrea riccioides* (Bolt.) Berk. which had been collected by Messieurs J. A. Wheldon and A. Wilson on the 12th of May last. They found it growing plentifully on apparently healthy Willows along the sides of ditches bordering the road between Dungeon Ghyll and Elter Water, Great Langdale, Westmorland. It was discovered by Bolton "on decaying branches of Sallow and Hazle" in February, 1790, and it is figured and described on the last plate 182 of his "History of Fungusses growing about Halifax." It has previously only been recorded from Glamis, Corby Castle, and the New Forest.

On Tuesday, the 15th of September, the members started in brakes at 8.30 from the Drumnadrochit Hotel, and a steep hill a little distance away had to be walked up, where Mr. H. C. Hawley gathered *Cortinarius* (*Phlegmacium*) *balteatus* Fr. The drive was then continued to Dunballoch Wood, which was reached about eleven o'clock; and Mr. Brown, Lord Lovat's forester, kindly undertook the guidance of the members from this point. Mr. D. A. Boyd soon found many interesting forms including *Pseudopeziza cerastiorum* (Wallr.) Fckl., *Ephelina prunellae* A.L.Sm., *Aecidium strobilinum* (A. & S.) Wint. and *Melanconis stilbostoma* (Fr.) Tul. Shortly after entering the wood, Mr. A. Cowan found a pretty yellow *Tricholoma*, which subsequent investigation proved to be new to science, and was named *Tricholoma luteocitrinum* Rea, a full description of which, with a plate, is set out at p. 125. Here were also gathered *Collybia mephitica* Fr., *Mycena rubromarginata* Fr., *Mycena rosella* Fr., *Polyporus Schweinitzii* Fr., and Mr. W. B. Allen found for the third time in Britain *Dianema corticatum* Lister. On leaving this plantation, a wood yard was carefully examined, and Mr. W. B. Allen secured for the first time in Scotland, the mycetozoon *Cribraria pyriformis* Schrad., though it has been recorded somewhat doubtfully for England. The walk was then continued down the road and the river Beauly was crossed; there the members found a welcome al fresco luncheon of bread and cheese awaiting them. Mr. Brown next conducted them into a large wood which was remarkable for the depth of its mossy carpet. In the course of this traverse, Professor R. H. Biffen and Mr. W. B. Allen were fortunate in collecting two magnificent examples of *Sparassis crispa* (Wulf) Fr. and *Sparassis laminosa* Fr. Here also Mr. D. A. Boyd gathered specimens of *Podosphaera myrtillina* Kunze and *Sordaria fimicola* Ces & de Not var. *canina* Boyd. On emerging from the wood, they came to another bridge over the Beauly, from which a very pretty torrential waterfall was much admired, and in a neighbouring saw yard some immature forms of *Enteridium olivaceum* Ehr. were detected. The grounds of Beaufort Castle were finally explored and Miss A. Lorrain Smith obtained specimens of *Stictis fimbriata* Schwein. on Pine Cones, a discomycete new to the British Fungus Flora. The members were then brought together and the carriages were re-entered near the stables at five o'clock. In the evening at eight-thirty, the members of both Societies were most hospitably entertained to dinner at Balmacaan by Mr. Bradley Martin, the President of the Cryptogamic Society of Scotland. In his speech, welcoming the members on their visit to the north, he incidentally referred to a paper by W. A. Murrill on "Collecting Fungi at

Biltmore," which appeared in the August number for the current year of the Journal of the New York Botanical Garden. The members were much impressed by the fact that a majority of the fungi recorded therein were common to the two countries, and this led Mr. D. A. Boyd to suggest later that an international meeting of British and American mycologists would be both highly interesting and instructive.

On Wednesday the 16th of September, the morning was occupied at the room by putting out on exhibition the specimens collected on the previous day, and in critically examining those of greater interest. About mid-day a start was made under the leadership of Mr. Angus Grant for the woods on the Balmacaan estate. There the most noteworthy finds included *Leptonia euchroa* (Pers.) Fr., *Nolanea icterina* Fr., *Inocybe cincinnata* Fr., *Inocybe hystrix* Fr., *Hypholoma dispersum* Fr., *Collybia semitalis* Fr., *Cortinarius (Phlegmacium) variicolor* (Pers.) Fr., *Cortinarius (Telamonia) armillatus* Fr., *Tremella tubercularia* Berk., *Lactarius vietus* Fr., *Lactarius fuliginosus* Fr., *Trogia crispa* (Pers.) Fr., *Psathyra semivestita* B. & Br., *Pistillaria puberula* Berk., *Cordyceps ophioglossoides* (Ehrh.) Link, *Hypocrea fungicola* Karst., *Ramularia ajugae* (Niessl.) Sacc. and *Phyllosticta mahoniana* Sacc.

In the evening, after the Cryptogamic Society of Scotland had held their business meeting, the British Mycological Society proceeded to hold their own, which had been unavoidably postponed from the previous evening. The President first, in feeling terms, referred to the death of their beloved Vice-President, Mr. Arthur Lister, and stated that he had attended his funeral not only as a personal friend, but to show their last tribute of affection and respect to a great and learned man. The members then in solemn silence passed the following resolution: "The British Mycological Society hereby record their great regret at the irreparable loss that Science and their Society have sustained by the death of their revered Vice-President, Arthur Lister, F.R.S., &c., who was endeared to them all by his many distinguished attainments and the kindly assistance that he so willingly extended to all their members. The members wish further to offer to Mrs. Arthur Lister and the family, their deepest sympathy in their bereavement, and to assure them that his memory will be always cherished with loving regard." Mr. Carleton Rea said they had also to deplore the loss of another great friend, though not a member, that was Dr. H. Cecil Moore of Hereford. All of them would remember the excellent arrangements that he made for them when they visited Hereford on the invitation of the Woolhope Club in 1902, and he had taken upon himself, as their President, to convey on their behalf, their sympathy with the great loss that the Wool-

hope Club had sustained by his death. The President's action in this matter was unanimously approved. Messieurs R. B. Johnstone, of 70, Cambridge Drive, Glasgow; W. Norwood Cheeseman, The Crescent, Selby; and Miss L. S. Gibbs, F.L.S., 22, South Street, Thurloe Square, London, were unanimously elected members. Professor M. C. Potter, M.A., was unanimously elected President for the ensuing year, and Professor R. H. Biffen, M.A., Vice-President, whilst the offices of Honorary Secretary and Treasurer were again confided to the retiring President Mr. Carleton Rea, B.C.L., M.A., &c. The thanks of the Club were then recorded to the Rev. W. L. W. Eyre, for his generosity in again giving them a plate, and to Mrs. Carleton Rea for her kindness in preparing the illustrations. The invitations for the holding of the foray in 1909 were next considered, and as the Rev. H. Purefoy Fitz-Gerald had removed recently from Wellington, it was considered doubtful whether he would be able to conduct them himself over the ground selected, and it was also uncertain whether Wellington could provide sufficient Hotel accommodation, as the present meeting had now convinced them that in the future, ample provision in that respect would be required, and a large centre chosen. Ultimately it was agreed to accept the invitation of their fellow member, Mr. Thomas Gibbs, to investigate the extensive woodlands and parks on the Haddon and Chatsworth estates of the Dukes of Rutland and Devonshire, who have already granted the permissions necessary for the foray. Bakewell or Rowsley were suggested as centres, but the final determination of that matter was left to the Hon. Secretary, and the date of holding the same was to be arranged by him in conjunction with Professor M. C. Potter, the President elect.* Mr. Carleton Rea then delivered his Presidential Address, entitled "Some remarks on basidia and spores, and the classification suggested by their study"† (see p. 60). And he also communicated a note by Monsieur Emile Boudier on Pseudophacidium Smithianum (see p. 81). Hearty votes of thanks were accorded to Mr. Bradley Martin for his right royal Highland welcome, and for his kind permission to explore his woods and policies; and the same was accorded to Lord Lovat for the Beaufort Castle and Beauly permits. Mr. Angus Grant was given quite an ovation for the excellent manner in which he had arranged the foray, provided accommodation in conjunction with Mr. D. D. Macdonald (to whom their thanks were also

* This has now been fixed and will be Monday to Saturday, 27th September to the 2nd October, 1909, with the Hotel at Baslow as Headquarters.

† In pursuance of a resolution passed on the 18th of September, "That the Presidential Address should be printed forthwith," the same was issued to the Members on the 31st of October, 1908.

due), and for the way in which he had led them in the field to the best hunting grounds.

On Thursday, the 17th of September, many of the members were in early attendance at the room, and it was close on noon before Mr. Angus Grant conducted them to the Borlum Woods. These woods proved most interesting and productive, and Mr. Angus Grant was again fortunate enough to secure some fine specimens of *Tricholoma decorum* (Fr.) Quél., which we think Quélet has assigned to its correct position. This plant was first added to the British Fungus Flora from this locality by Mr. Angus Grant, and it now seems well established there. The following species were collected during the day: *Hydnum imbricatum* Linn., *Pholiota flammans* Fr., *Armillaria robusta* (A. & S.) Fr., *Bulgariella pulla* (Fr.) Karst., *Tricholoma portentosum* Fr., *Tricholoma equestre* (Linn.) Fr., *Lactarius sanguifluus* Fr., *Pleurotus porrigens* (Pers.) Fr., *Omphalia umbellifera* (Linn.) Fr., *Polyporus brumalis* (Pers.) Fr., *Uromyces orobi* (Pers.) Wint., *Uromyces anthyllidis* (Grev.) Schröt., *Puccinia circaeae* Pers., *Tilletia decipiens* (Pers.) Schröt., *Hygrophorus agathosmus* Fr., *Pholiota erebia* Fr., *Physarum viride* Pers., and the rare *Dianema corticatum* List. This last was collected by Mr. W. B. Allen. After their return, Mr. Angus Grant brought in from his garden at Drumnadrochit, an extreme form of *Inocybe haemacta* B. & Cke., the pileus was blood red on the surface but the stem revealed the characteristic aeruginous colour at its base on section. In the evening at 8.30, in the dining-room at the Drumnadrochit Hotel, Professor R. H. Biffen, M.A. gave a lecture on *Sphaerotheca mors-uvae* B. & C. He stated that it was first observed by our member, Professor E. Salmon, in the north-west of Ireland in 1900, since then it had spread with devastating effect into other English counties, Worcestershire and Norfolk being the most affected. It was a most virulent disease and must be stamped out. It had occurred in Germany, Russia, Sweden and Denmark, and all importation of Ribes stocks from these countries should be prohibited. The fungus should be attacked in its resting stage and all diseased trees uprooted and burnt. In the conidial condition its treatment with dilute solution of liver of sulphur was recommended, but this should be done every ten days, a rather costly process, and it would be much better to eradicate the bushes. Miss H. C. I. Fraser, D.Sc., F.L.S., then gave an interesting demonstration of "Recent work on the reproduction of Ascomycetes," illustrated by numerous lantern slides (see p. 100), and afterwards some very excellent slides by our member Dr. C. Theodore Green, F.L.S., were thrown on the screen by the kind assistance of Mr. W. C. Crawford, M.A., F.R.S.E., who had brought his own oil lantern to the meeting for the illustration of Dr. Fraser's paper.

Dr. Green's slides included examples of *Amanita muscaria, rubescens; Tricholoma saponaceum, album; Clitocybe geotropa; Collybia velutipes, confluens; Mycena galericulata, galopa; Pleurotus pantoleucus; Hypholoma fasciculare; Coprinus comatus; Russula ochroleuca, alutacea, foetens nigricans, furcata; Lactarius pallidus, rufus, turpis; Hygrophorus hypothejus; Paxillus involutus; Boletus scaber, calopus, badius, luridus, elegans; Polyporus Wynniae, betulinus, igniarius, squamosus, salignus, versicolor; Stereum hirsutum; Scleroderma vulgare; Hirneola auricula-Judae; Leotia lubrica; Peziza vesciculosa; Calocera viscosa* and *Ithyphallus impudicus*. The exhibition of the slides was greatly admired, and all agreed that they were the best that they had seen, and a very great advance on those usually submitted for their inspection. Miss A. Lorrain Smith, F.L.S., next gave some very interesting details respecting some recent additions to the British Fungus Flora which are fully set out in her paper at p. 111.

On Friday, the 18th of September, the fore-noon was busily occupied with the examination of the specimens brought in on the previous day, so that it was well past 12.30 p.m. before the members drove some six miles in a westward direction down Loch Ness to the Lennie Woods. The investigation of these woods resulted in several uncommon species being added to the list, amongst which we may enumerate *Lactarius scrobiculatus* (Scop.) Fr., the scarce *Pholiota caperata* (Pers.) Fr., (=*Rozites caperata* (Pers.) Karst.), *Hygrophorus russocoriaceus* B. & Br., *Cortinarius (Phlegmacium) largus* (Buxbaum) Fr.; *C. (Telamonia) bivelus* Fr.; *Cantharellus muscigenus* (Bull.) Fr., *Mycena acicula* (Schaeff.) Fr., *Synchytrium succisae* de Bary and Wor., *Helvella lacunosa* Afzel, *Helvella elastica* Bull, and *Entoloma rhodopolium* Fr. In the evening at 8.30 two papers were read by the Hon. Sec., on "Omitted Asci measurements of some British Discomycetes," by Mr. Charles Crossland, F.L.S., (see p. 85); and "On the bleeding disease of the Cocoanut Tree in Ceylon," by Mr. T. Petch, B.A., B.Sc. (see p. 108), kindly communicated by our member Dr. Charles B. Plowright, M.D. Over five hundred and eighty species were collected during the foray, and for the record of the micro-fungi we are very greatly indebted to the researches of Mr. D. A. Boyd and Miss A. Lorrain Smith, F.L.S. The former sent in a list of over one hundred and fifty species, and the latter has determined as new, two species of moulds that were collected by Messrs. Allen and Rea, in the Divach woods, viz: *Tilachlidium subulatum* A.L.Sm. and *Monilia humicola* Oud. var. *brunnea* A.L.Sm. Miss A Lorrain Smith also records from the Beauly Woods *Myxococcus pyriformis* A.L.Sm. (see p. 82).

COMPLETE LIST OF FUNGI GATHERED DURING THE FORAY.

Amanita phalloides (Vaill.) Fr., mappa (Batsch) Fr., muscaria (Linn.) Pers., pantherina (DC.) Fr., rubescens Fr.

Amanitopsis vaginata (Bull.) Roze, fulva (Schaeff.) W. Sm.

Lepiota procera (Scop.) Fr., rhacodes (Vitt.) Fr., gracilenta (Krombh.) Fr., clypeolaria (Bull.) Fr., cristata (A. & S.) Fr., carcharias (Pers.) Fr., amianthina (Scop.) Fr.

Armillaria robusta (A. & S.) Fr., mellea (Fl.D.) Fr.

Tricholoma equestre (Linn.) Fr., portentosum Fr., resplendens Fr., flavobrunneum Fr., albobrunneum (Pers.) Fr., rutilans (Schaeff.) Fr., decorum (Fr.) Quél., luteocitrinum Rea, imbricatum Fr., vaccinum (Pers.) Fr., terreum (Schaeff.) Fr., saponaceum Fr., sulphureum (Bull.) Fr., bufonium (Pers.) Fr., album (Schaeff.) Fr., grammopodium (Bull.) Fr.

Clitocybe nebularis (Batsch) Fr., clavipes (Pers.) Fr., virens (Scop.) Fr. (= viridis With.), odora (Bull.) Fr., rivulosa (Pers.) Fr., pithyophila Fr., fumosa (Pers.) Fr., infundibuliformis (Schaeff.) Fr., geotropa (Bull.) Fr., inversa (Scop.) Fr., cyathiformis (Bull.) Fr., concava (Scop.) Fr., metachroa Fr., ditopa Fr., fragrans (Sow.) Fr.

Laccaria laccata (Scop.) Berk., var. amethystina (Scop.) Berk.

Collybia radicata (Relhan) Fr., platyphylla Fr., semitalis Fr., butyracea (Bull.) Fr., velutipes (Curt.) Fr., conigena (Pers.) Fr., cirrhata (Pers.) Fr., tuberosa (Bull.) Fr., xanthopa Fr., acervata Fr., dryophila (Bull.) Fr., aquosa (Bull.) Fr., rancida Fr., mephitica Fr., clusilis Fr.

Mycena pelianthina (Pers.) Fr., Iris Berk., rubromarginata Fr., rosella Fr., pura (Pers.) Fr., flavoalba Fr., lactea Pers., rugosa Fr., galericulata (Scop.) Pers., polygramma (Bull.) Pers., leptocephala Pers., alcalina Fr., ammoniaca Fr., umbellifera (Schaeff.) Quél., stannea Fr., filopes (Bull.) Fr., amicta Fr., plumbea Fr. acicula (Schaeff.) Fr., haematopa Pers., sanguinolenta (A. & S.) Fr., galopa Pers., epipterygia (Scop.) Pers., vulgaris (Pers.) Fr., corticola (Schum.) Fr.

Omphalia rustica Fr., umbellifera (Linn.) Fr., grisea Fr., fibula (Bull.) Fr., and var. Swartzii Fr., integrella (Pers.) Fr.

Pleurotus corticatus Fr., porrigens (Pers.) Fr., chioneus (Pers.) Fr.

Pluteus cervinus (Schaeff.) Fr., salicinus (Pers.) Fr., chrysophaeus (Schaeff.) Fr.
Entoloma lividum (Bull.) Fr., Bloxami Berk., ameides B. & Br., jubatum Fr., griseocyaneum Fr., rhodopolium Fr., sericeum (Bull.) Fr., nidorosum Fr.
Clitopilus prunulus (Scop.) Fr.
Leptonia lampropa Fr., serrulata Fr., euchroa (Pers.) Fr., sericella (Fr.) Quél., incana Fr.
Nolanea pascua (Pers.) Fr., pisciodora (Cesati) Fr., icterina Fr.
Claudopus variabilis (Pers.) W.Sm.
Pholiota caperata (Pers.) Fr., erebia Fr., radicosa (Bull.) Fr., spectabilis Fr., flammans Fr., mutabilis (Schaeff.) Fr., marginata (Batsch) Fr., pumila Fr.
Inocybe hystrix Fr., calamistrata Fr., hirsuta (Lasch) Fr., dulcamara (A. & S.) Fr., cincinnata Fr., pyriodora (Pers.) Fr., obscura (Pers.) Fr., haemacta B. & Cke., rimosa (Bull.) Fr., eutheles B. & Br., geophylla (Sow.) Fr. and var. lilacina Fr., cervicolor (Pers.) Quél., petiginosa (Fr.) Quél.
Hebeloma fastibile Fr., glutinosum (Lindgr.) Fr., mesophaeum Fr., crustuliniforme (Bull.) Fr. and var. minor Cke.
Flammula carbonaria Fr., alnicola Fr., inopa Fr., sapinea Fr., scamba Fr.
Naucoria melinoides (Bull.) Fr., badipes Fr., escharoides Fr.
Galera tenera (Schaeff.) Fr., spartea Fr., hypnorum (Schrank) Fr.
Tubaria furfuracea (Pers.) W.Sm., crobula Fr.
Crepidotus alveolus (Lasch) Fr., mollis (Schaeff.) Fr.
Agaricus xanthoderma Genév., campestris Linn. and var. silvicola Vitt., comtulus Fr.
Stropharia aeruginosa (Curt) Fr., albocyanea (Desm.) Fr., squamosa (Pers.) Fr., stercoraria Fr., semiglobata (Batsch) Fr.
Hypholoma sublateritium Fr., capnoides Fr., fasciculare (Huds.) Fr., dispersum Fr., appendiculatum (Bull.) Fr.
Psilocybe sarcocephala Fr., semilanceata Fr., foenisecii (Pers.) Fr.
Psathyra corrugis (Pers.) Fr., bifrons Berk., semivestita B. & Br., fibrillosa (Pers.) Fr.
Panaeolus sphinctrinus Fr., campanulatus (Linn.) Fr., papilionaceus (Bull.) Fr.
Psathyrella gracilis Fr., atomata Fr.
Coprinus atramentarius (Bull.) Fr., cinereus (Schaeff.) Fr., niveus (Pers.) Fr., micaceus (Bull.) Fr., lagopus Fr., radiatus (Bolt.) Pers., plicatilis (Curt.) Fr.
Bolbitius vitellinus (Pers.) Fr.
Cortinarius (Phlegmacium) triumphans Fr., balteatus Fr., variicolor (Pers.) Fr., largus (Buxbaum) Fr., infractus

(Pers.) Fr., multiformis Fr., purpurascens Fr., subpurpurascens (Batsch) Fr., turbinatus (Bull.) Fr., fulgens (A. & S.) Fr., emollitus Fr.
(Myxacium) collinitus (Pers.) Fr., mucosus (Bull.) Fr. elatior Fr., mucifluus Fr.
(Dermocybe) tabularis (Bull.) Fr., caninus Fr., lepidopus Cke., anomalus Fr., miltinus Fr., cinnabarinus Fr., cinnamomeus (Linn.) Fr. and var. semisanguineus Fr., cotoneus Fr.
(Telamonia) bivelus Fr. armillatus Fr., hinnuleus (Sow.) Fr., brunneus (Pers.) Fr., hemitrichus (Pers.) Fr., rigidus (Scop.) Fr., paleaceus Fr.
(Hydrocybe) castaneus (Bull.) Fr., pateriformis Fr., rigens (Pers.) Fr., leucopus (Pers.) Fr., decipiens (Pers.) Fr., obtusus Fr.

Gomphidius glutinosus (Schaeff.) Fr., viscidus (Linn.) Fr., gracilis Berk.

Paxillus giganteus (Sow.) Fr., involutus (Batsch) Fr., atrotomentosus (Batsch) Fr.

Hygrophorus eburneus (Bull.) Fr., cossus (Sow.) Fr., hypothejus Fr., agathosmus Fr., pratensis (Pers.) Fr., virgineus (Wulf) Fr., niveus (Scop.) Fr., russocoriaceus B. & Br., ceraceus (Wulf) Fr., coccineus (Schaeff.) Fr., miniatus Fr., turundus Fr. var. mollis B. & Br., puniceus Fr., obrusseus Fr., conicus (Scop.) Fr., chlorophanus Fr., nitratus (Pers.) Fr.

Lactarius scrobiculatus (Scop.) Fr., torminosus (Schaeff.) Fr., turpis (Weinm.) Fr., pubescens Fr., blennius Fr., uvidus Fr., pyrogalus (Bull.) Fr., vellereus Fr., deliciosus (Linn.) Fr., sanguifluus Fr., quietus Fr., aurantiacus (Fl.D.) Fr., vietus Fr., rufus (Scop.) Fr. and var. exumbonatus Boud., glyciosmus Fr., fuliginosus Fr., mitissimus Fr., subdulcis (Bull.) Fr.

Russula nigricans (Bull.) Fr., delica (Vaill.) Fr., chloroides (Kromb.) Bres., furcata (Lam.) Pers., depallens (Pers.) Fr., caerulea (Pers.) Fr., rubra (DC.) Fr., cyanoxantha (Schaeff.) Fr., galochroa Fr., foetens Pers. drimeia Cke. (= expallens Gillet), fragilis (Pers.) Fr. and var. violacea Quél and var. nivea (Pers.), integra (Linn.) Fr., nitida (Pers.) Fr., puellaris Fr., alutacea Pers., lutea (Huds.) Fr., armeniaca Cke.

Cantharellus cibarius Fr., aurantiacus (Wulf) Fr., tubaeformis (Bull.) Fr., infundibuliformis (Scop.) Fr., cupulatus Fr. muscigenus (Bull.) Fr.

Nyctalis parasitica (Bull.) Fr.

Marasmius peronatus (Bolt.) Fr., oreades (Bolt.) Fr., ramealis (Bull.) Fr., androsaceus (Linn.) Fr. epiphyllus Fr.

Panus torulosus (Pers.) Fr., stipticus (Bull.) Fr.

Trogia crispa (Pers.) Fr.
Lenzites betulina (Linn.) Fr.
Boletus luteus Linn., elegans Schum., bovinus Linn., badius Fr., piperatus Bull., variegatus Swartz., chrysenteron Bull., subtomentosus Linn., pruinatus Fr., edulis Bull., luridus Schaeff., laricinus Berk., versipellis Fr., scaber Bull.
Fistulina hepatica (Huds.) Fr.
Polyporus brumalis (Pers.) Fr., Schweinitzii Fr., perennis (Linn.) Fr., squamosus (Huds.) Fr., umbellatus (Pers.) Fr., adustus (Willd.) Fr., amorphus Fr., borealis (Wahl.) Fr., betulinus (Bull.) Fr.
Fomes applanatus (Pers.) Wallr., nigricans Fr., igniarius (Linn.) Fr., annosus Fr.
Polystictus radiatus (Sow.) Fr., versicolor (Linn.) Fr., abietinus (Dicks.) Fr.
Poria terrestris (DC.) Fr., mucida Pers., mollusca (Pers.) Fr.
Daedalea quercina (Linn.) Pers.
Merulius tremellosus Schrad., lacrymans (Wulf.) Schum.
Hydnum imbricatum Linn., repandum Linn. and var. rufescens Pers., auriscalpium Linn., udum Fr., niveum Pers.
Irpex obliquus (Schrad.) Fr.
Radulum quercinum (Pers.) Fr.
Grandinia granulosa (Pers.) Fr.
Craterellus cornucopioides (Linn.) Pers.
Thelephora laciniata Pers.
Stereum purpureum Pers., hirsutum (Willd.) Pers., sanguinolentum (A. & S.) Fr., rugosum Pers.
Peniophora quercina (Pers.) Cke., gigantea (Fr.) Cke., cinerea (Pers.) Cke.
Corticium sanguineum Fr., calceum (Pers.) Fr., nudum Fr.
Coniophora puteana (Schum.) Fr.
Sparassis crispa (Wulf.) Fr., laminosa Fr.
Clavaria cristata (Holmsk.) Pers., rugosa Bull., abietina Pers., fusiformis Sow., pistillaris Linn.
Typhula erythropus (Pers.) Fr.
Pistillaria puberula Berk.
Tremella, mesenterica Retz., tubercularia Berk.
Ulocolla foliacea (Pers.) Bref.
Exidia albida (Huds.) Bref.
Calocera viscosa (Pers.) Fr., cornea (Batsch) Fr., stricta Fr.
Dacrymyces stillatus Nees, deliquescens (Bull.) Duby.
Scleroderma vulgare Fl.D.
Cyathus striatus (Huds.) Hoffm.
Crucibulum vulgare Tul.
Sphaerobolus stellatus Tode.
Lycoperdon hiemale Bull. (= depressum Bon.), perlatum (Pers.)

Scop., pyriforme Schaeff. and var. excipuliforme Desm., umbrinum Pers.
Bovista nigrescens Pers.
Uromyces fabae (Pers.) Cke., orobi (Pers.) Wint., trifolii (A. & S.) Wint., anthyllidis (Grev.) Schröt., alchemillae (Pers.) Wint.
Puccinia galii (Pers.) Wint., lapsanae (Schultz.) Fckl., variabilis Grev., pulverulenta Grev., violae (Schum.) Wint., pimpinellae (Strauss) Wint., primulae (DC.) Grev., rubigo-vera (DC.) Wint., suaveolens (Pers.) Wint., centaureae Mart., oblongata (Link) Wint., arenariae (Schum.) Wint., malvacearum Mont., circaeae Pers., annularis (Strauss) Wint.
Phragmidium fragariastri (DC.) Schröt., violaceum (Schultz.) Wint., subcorticatum (Schrank) Wint., rubi-idaei (Pers.) Wint.
Gymnosporangium juniperinum (Linn.) Wint.
Melampsora farinosa (Pers.) Wint., betulina (Pers.) Desm., vacciniorum (Link) Schröt., cerastii (Pers.) Wint.
Coleosporium senecionis (Pers.) Wint., tussilaginis (Pers.) Lév., campanulae (Pers.) Wint., euphrasiae (Schum.) Wint.
Aecidium strobilinum (A. & S.) Wint.
Synchytrium succisae de Bary & Woronin.
Mucor caninus Pers., erectus Bain.
Spinellus fusiger (Link.) Van Tiegh.
Pilaira anomala (Ces.) Van Tiegh.
Pilobolus crystallinus (Wiggers) Tode.
Phytophthora infestans (Mont.) de Bary.
Cystopus candidus (Pers.) Lév.
Bremia lactucae Regel.
Peronospora urticae (Lib.) de Bary.
Protomyces macrosporus Ung., pachydermus Thüm.
Tilletia decipiens (Pers.) Körn.
Schinzia alni Woronin.
Podosphaera myrtillina (Schubert) Kunze. New to Britain.
Erysiphe martii Lév., umbelliferarum de Bary., cichoracearum DC.
Microsphaera grossulariae (Wallr.) Lév.
Uncinula aceris (DC.) Sacc.
Asterina veronicae (Lib.) Cke.
Gibberella pulicaris (Fr.) Sacc.
Hypocrea rufa (Pers.) Fr., fungicola Karst.
Cordyceps ophioglossoides (Ehrh.) Link.
Chaetomium bostrychoides Zopf.
Sordaria fimicola Ces & de Not var. canina (Karst.) Boyd.
Podospora decipiens Wint., minuta (Fckl.) Wint.
Sporormia minima Auersw.

Leptospora spermoides (Hoffm.) Fckl.
Melanomma pulvis-pyrius (Pers.) Fckl.
Cucurbitaria berberidis (Pers.) Gray.
Stigmatea robertiani Fr.
Sphaerella vaccinii Cke.
Laestadia faginea (Awd.) Cke. & Phil.
Venturia (= Sphaerella) rumicis (Desm.) Cke.
Leptosphaeria acuta (Moug.) Karst.
Massaria inquinans (Tode) Fr.
Diaporthe nucleata (Cur.) Sacc.
Eutypa lata (Pers.) Tul.
Valsa ambiens (Pers.) Fr.
Cryptospora suffusa (Fr.) Tul., betulae Tul.
Melanconis stilbostoma (Fr.) Tul.
Melogramma (= Sillia) ferrugineum (Pers.) Ces & de Not.
Diatrype stigma (Hoffm.) de Not.
Hypoxylon fuscum (Pers.) Fr.
Ustulina vulgaris Tul.
Xylaria hypoxylon (Linn.) Grev.
Phyllachora junci (Fr.) Fckl., podagrariae (Roth.) Karst.
Dothidea tetraspora B. & Br., ribesia (Pers.) Fr.
Rhopographus pteridis (Sow.) Wint.
Curreyella aucupariae A.L.Sm.
Elaphomyces cervinus (Pers.) Schröter (= granulatus Fr.)
Spathularia clavata (Schaeff.) Sacc.
Leotia lubrica Pers.
Helvella lacunosa Afzel., elastica Bull.
Rhizina inflata (Schaeff.) Karst.
Otidea leporina (Batsch) Fckl., aurantia (Pers.) Mass.
Peziza sepiatra Cke., badia Pers.
Humaria carbonigena (Berk.) Sacc., melaloma (Fckl.) Mass., violacea (Pers.) Sacc.
Dasyscypha calycina (Schum.) Fckl.
Lachnea scutellata (Linn.) Gill., hemispherica (Wigg.) Gill.
Chlorosplenium aeruginosum (Oed.) de Not.
Ciboria ochroleuca (Bolt.) Mass.
Helotium claroflavum (Grev.) Berk., citrinum (Hedw.) Fr., calyculus (Sow.) Berk., epiphyllum (Pers.) Fr.
Mollisia rubi (Fr.) Karst.
Pseudopeziza trifolii (Bern.) Fckl., cerastiorum (Wallr.) Fckl.
Ascophanus carneus Boud.
Ascobolus vinosus Berk.
Coryne urnalis (Nyl.) Karst., sarcoides (Jacq.) Tul.
Bulgariella pulla (Fr.) Karst.
Bulgaria polymorpha (Oeder) Wettstein.
Propolis rhodoleuca (Sommf.) Fr.
Stictis radiata (Linn.) Pers., fimbriata Schwein. New to Britain.

Ephelina prunellae Phill.
Rhytisma acerinum (Pers.) Fr., punctatum (Pers.) Fr., salicinum (Pers.) Fr.
Trochila craterium (DC.) Fr., lauro-cerasi (Desm.) Fr.
Coccomyces quadratus (Schm. & Kunze) Karst.
Dichaena quercina (Pers.) Fr.
Lophodermium cladophilum (Lév.) Rehm, pinastri (Schrad.) Chev. juniperinum Fr., de Not.
Hypoderma virgultorum DC., conigenum (Pers.) Cke.
Phyllosticta mahoniana (Sacc.) New to Britain, sambuci Desm., teucrii Sacc. & Speg.
Actinonema rosae (Lib.) Fr.
Septoria hyperici Desm., stellariae Rob. & Desm., podagrariae Lasch., stachydis Rob. & Desm., urticae Desm. & Rob.
Camarosporium macrosporum (B. & Br.) Sacc.
Gloeosporium betulae (Lib.) Mont., fagi (Desm. & Rob.) West. paradoxum (de Not.) Fckl., umbrinellum B. & Br., ribis (Lib.) Mont. & Desm.
Melanconium bicolor Nees., sphaeroideum Link.
Asterosporium Hoffmanni Kunze.
Staganosporium piriforme Hoffm.
Monilia humicola Oedm. var. brunnea A.L.Sm. New variety.
Oidium monilioides (Nees) Link., erysiphoides Fr.
Trichoderma lignorum (Tode) Harz.
Sepedonium chrysospermum (Bull.) Fr.
Ovularia obliqua (Cke.) Oud., veronicae (Fckl.) Sacc.
Didymaria didyma (Unger) Schröt (= Ungeri) Cda.
Ramularia ajugae (Niessl) Sacc., calcea (Desm.) Ces., variabilis Fckl., urticae Ces.
Cercospora mercurialis Fckl.
Coniothecium betulinum Cda.
Isaria farinosa (Dicks.) Fr.
Tilachlidium subulatum A.L.Sm. Genus new to Britain.
Stilbum tomentosum Schr., erythrocephalum Ditm.
Tubercularia vulgaris Tode.

*Mycetozoa**

Ceratiomyxa mucida Schroet. *Balmacaan.*
Physarum nutans Pers., abundant; viride Pers. *Beaufort* and *Borlum* Woods.
Fuligo septica Gmel. *Beaufort.*
Stemonitis fusca Roth. *Beaufort.*
Comatricha obtusata Preuss. *Balmacaan.*

* These were kindly determined by our Members, Miss Gulielma Lister, F.L.S., and W. B. Allen.

Cribraria pyriformis Schrad. *Dunballoch* near *Beaufort.* (First record for Scotland).

Tubulina fragiformis Pers. abundant.

Enteridium olivaceum Ehr. *Beaufort.*

Trichia affinis de Bary *Balmacaan;* varia Pers. *Beaufort.*, fallax Pers. *Balmacaan.*

Arcyria ferruginea Sauter, *Dunballoch* near *Beaufort*, incarnata Pers. *Beaufort.*

Dianema corticatum List., *Dunballoch* near *Beaufort* and *Borlum* (Third British record).

Lycogala miniatum Pers. *Beaufort.*

Myxobacteriaceae.

Myxococcus pyriformis A.L.Sm. Beauly Woods.

PRESIDENTIAL ADDRESS.

By Carleton Rea, B.C.L., M.A., &c.

SOME REMARKS ON BASIDIA AND SPORES AND THE CLASSIFICATION SUGGESTED BY THEIR STUDY.

Doctor W. E. Hoyle, in his Presidential Address to the Zoological Section of the British Association at Leicester last year, stated "that the speaker who treats of the subject matter of his own researches has the best prospect of making his remarks interesting and profitable to his audience." I propose to follow his lead and to deal only with those branches of the great group of Fungi that I have from time to time been brought into contact with. Up to the present time our systematic British books dealing with the **BASIDIOMYCETAE** have been principally based on the classification adopted by the illustrious Fries in his *Hymenomycetes Europaei*, which was published in 1874. Since that date a closer investigation of the basidia and spores has been undertaken by numerous workers, and has led various authors to propound several new schemes of classification and re-arrangement of the species. Of course it would be impossible for me in this address to draw your attention to the salient points in most of them, so I shall content myself with directing your notice to the one outlined by Monsieur N. Patouillard in 1900 in his "*Essai taxanomique sur les familles*

et les genres des Hyménomycètes." This work has greatly assisted me, and I consider that the classification there outlined has many very valuable points which we should adopt. The splitting up of the old genera *Corticium* and *Thelephora* are, I think, of inestimable value. I shall confine my observations to European species because I quite agree with T. Petch, who is doing such magnificent work in the redescription of Ceylon fungi on the spot. In his *Revisions of Ceylon Fungi* he states, p. 38: "At the present time, if the name of a Ceylon fungus is required, the *modus operandi* is as follows. In the first place it must be compared with Berkeley's descriptions of Thwaites' species and the original specimens and drawings, in order to find out what Berkeley then named it, and *how many times he named it.* Then a search must be made through the descriptions of Gardner's species to see whether it was named in 1846. If the specimen happens to be a *Polyporus* there must be a further reference to König's species. This process generally gives ultimately several names for each species, and the synonymy can in some cases be further lengthened by considering Cesati's descriptions of the specimens collected by Beccari. All doubtful cases are reserved, and no decision arrived at until a large number of specimens have been examined. In this way the synonymy of the species, *as far as Ceylon is concerned*, may be definitely determined, though progress is extremely slow. But this gives no idea whatever of the number of times it has been named on specimens from other countries. It seems to me that the only possible way in which any definite knowledge can be evolved out of the present chaos is that mycologists of each tropical country should work out their species in a similar manner, and that when this is done they should interchange specimens and coloured drawings of at any rate their common forms. But if the original collections were not returned to the sender there is no possibility of ever arriving at a definite conclusion, and the existing records are merely so much waste paper. Certainly the present practice of consigning **BASIDIOMYCETAE** to Europe is a waste of time. The describers not only fail to recognize a species: in many cases they do not hit upon the right genus. The descriptions are unrecognizable, and the 'species' on which they are founded are often only damaged or abnormal forms of common things. The latter is especially the case when, as so often happens at the present day, the actual collecting is entrusted to coolies. *The mycologist must collect his own specimens and know them under all conditions.*" This last assertion, I cordially endorse and say that it is equally important for the right determination of European species.

Patouillard divides the **BASIDIOMYCETAE** into two

sub-classes, the **Heterobasidiae**, which is equivalent to the **Protobasidiae** of Brefeld and the **Homobasidiae** which quadrates with Brefeld's **Autobasidiae.** In the former the basidia are either septate or the spores on germination give rise to a promycelium bearing promycelial spores, whereas in the latter the basidia are unseptate and the spores directly germinate with a true mycelium.

The **Heterobasidiae** he arranges under four families. 1, AURICULARIACEAE, having transversely septate basidia; 2, TREMELLACEAE, having cruciately divided basidia; 3, TULASNELLACEAE, having unseptate, globose basidia with thick sterigmata; and 4, CALOCERACEAE, having cylindric basidia with two long pointed sterigmata. These four families were included by Fries in the TREMELLINEI and CLAVARIEI. Patouillard places under the AURICULARIACEAE the tribes PUCCINIALES, USTILAGINALES, COLEOSPORALES and AURICULARIALES. It is to this last tribe that I wish to draw your attention, because it contains the genus *Helicobasidium* Pat., the species of which were formerly placed by Tulasne in the genus *Hypochnus* Fr. *Helicobasidium*, as its Latin name suggests, is characterized by the curved form of its transversely septate basidium, which readily separates it from *Hypochnus* Fr. and *Corticium* Fr. In the spring of this year the Revd. Eyre sent me on a specimen of *Helicobasidium purpureum* Pat. and I was then unaware that it had been recorded for Britain, but I have since ascertained that it is known to the Kew authorities. Patouillard enumerates under *Auricularia* Bull. both *Auricularia mesenterica* Fr. and *Auricularia auricula-Judae* Linn., and I must confess that for many years I have failed to see where there was any distinction between the genus *Auricularia* Bull. and *Hirneola* Fr. He then happily places at the end of this family the tribe ECCHYNALES, which are angiocarpous forms with transversely septate basidia. It includes the genus *Ecchyna* Fr., which is wrongly referred to in many books as *Pilacre* (Fr.) Bref. Fries in his *Systema mycologicum* III., 204, says the genus *Pilacre* Fr. has the appearance of *Vibrissea* Fr., and Boudier in his recent *Histoire et Classification des Discomycètes d'Europe* 91 retains it in close proximity to that genus. It therefore follows that we must in the future record these species as *Ecchyna faginea* Fr. and *Petersii* (B. & Br.) Pat.

In the TREMELLACEAE the most important genus to direct your attention to is *Sebacina* Tul., which embraces the well-known species *Sebacina incrustans* (Pers.) Tul. and *calcea* Bres. along with many others. These were formerly ranged in *Thelephora* Fr. and *Corticium* Fr., but as they possess cruciately divided basidia it is clear that they must be separated from

these badly defined genera in the Friesian sense and a stricter definition adopted for the limitation of the species included thereunder.

The **BASIDIOMYCETAE Homobasidiae** Patouillard divides into normal and abnormal, and under the latter head he puts the family of EXOBASIDIACEAE, which is adapted to a parasitic life, whilst under the former he enumerates three families, the I. APHYLLOPHORACEAE gymnocarps with indefinite, amphigenous or unilateral hymenia spread out over either a smooth, pointed or porous surface; II. AGARICACEAE hemiangiocarps with definite hymenia, typically inferior and spread out over the surface of gills, and III. GASTEROMYCETAE angiocarps. The APHYLLOPHORACEAE include in a single family the POLYPOREI, HYDNEI, THELEPHOREI and CLAVARIEI of Fries. They are specially characterized by the indefinite growth of the hymenial surface. Their receptacle is at first like a bare wart at the extremity of which the first traces of the hymenial elements appear. As the wart spreads, fresh basidia appear between the original hymenial elements and the extremity of the hymenium, until the complete development of the fungus is attained; and then the older portion of the hymenium is disclosed nearest the base of the plant.

He then separates the APHYLLOPHORACEAE into two tribes, the CLAVARIALES having an upright, dendroid receptacle, either simple or branched, but never pileate, and an amphigenous hymenium, and the POROHYDNALES, having a resupinate or pileate receptacle either sessile or stalked and an inferior hymenium. The CLAVARIALES he arranges in two series, the THELEPHOREI comprising the tenacious, hardy, persistent species, and the CLAVARIEI embracing the fleshy, putrescent species. The THELEPHOREI include three genera, 1 *Cristella* Pat., 2 *Pterula* Fr., and 3 *Thelephora* Fr., all of which have white spores. *Cristella* Pat. is distinguished from *Thelephora* Fr. by possessing echinulate spores, and he transfers to it *Cristella cristata* (Pers.) Pat. as the type of his new genus, which does not correspond with *Soppittiella* Mass., because that genus is characterized by its coloured echinulate spores. *Thelephora* (Fr.) Pat. he restricts to such species as *Thelephora pallida* Pers. and *contorta* Karst. *Clavaria* Fr. is broken up into two subgenera, *Ramaria* Holmsk. having a common fleshy trunk bearing numerous branches clothed with the hymenium, and *Clavaria* Fr. having a simple receptacle with a sterile stem passing insensibly into the clavate fertile portion. These subgenera I consider might with advantage be raised to generic rank, as they would then connote distinctions easily appreciable by every mycologist. The POROHYDNALES correspond to

a great extent to the POLYPOREI, HYDNEI and some of the THELEPHOREI as defined by Fries, and are characterized by having a spreading receptacle that is either resupinate, dimidiate or stalked, but never clavate. Patouillard groups them under four tribes, the CYPHELLAE having the hymenium in cup-shaped receptacles, the ODONTIAE having a plain or variously rugose hymenium, the PORI having the hymenium in tubes arising from a thick receptacle, and the HYDNA having the hymenium on protuberances directed downwards. The CYPHELLAE include four genera, 1 *Aleurodiscus* Rabh., 2 *Cytidia* Quél., 3 *Cyphella* Fr., and 4 *Porothelium*, all of which have white spores. The first three genera have no stroma or only a floccose one. In *Aleurodiscus* Rabh. the basidia and spores are large, though in *Cytidia* Quél. and *Cyphella* Fr. they are small. *Cytidia* Quél. is of a gelatinous consistency, whereas *Cyphella* Fr. is of a waxy or firmer nature, cup-shaped or tubular, and either sessile or stipitate. In *Porothelium* Fr. the stroma is membranous and the hymenium is concave. The genus *Aleurodiscus* Rabh. is easily recognized by its enormous basidia, which contain large oil drops. It includes *Aleurodiscus amorphus* (Pers.), a species that is not uncommon on Fir wood. It was formerly placed under *Corticium* Fr., as was also *C. salicinum* Fr., which is now referred to *Cytidia rutilans* (Pers.) Quélet. The ODONTIAE he separates into three series, all having white spores. I. The ODONTIAE consist of resupinate species which lead up to the PORI; II. the CORTICIA on the other hand are resupinate species leading up to the HYDNA, and III. the STEREA are lamellar in form, with free margins and are either dimidiate or stalked. The ODONTIAE include two genera, 1 *Epithele* Pat. having a floccose surface with scattered protuberances, which is well illustrated by *Epithele Typhae* (Fuckl.) Pat., a species that was formerly considered a *Hypochnus* Fr.; and 2 *Odontia* Fr. possessing a membranaceous or crustaceous surface covered with scattered fimbriate or ciliated protuberances, but I consider that it would be much better to define this genus as being made up of all white spored resupinate species having teeth or other protuberances, those with coloured spores being placed in the genus *Phaeodon* Schröt. section *Hydnopsis* Schröt., which I should raise to full generic rank and call *Odontia* and *Hydnopsis*, just as we call all the resupinate POLYPORACEAE *Poria* Fr., but we shall see later that Patouillard considers all members of this genus are degenerate species of those included in other groups. The CORTICIA are represented by five genera with white spores. 1. *Hypochnus* Fr. is of a floccose consistency and has a smooth hymenium; it is characteristically represented by *Hypochnus sulphureus* Fr. and *serus* Fr. The other four genera are of

either a membranaceous or crustaceous or waxy nature. 2. *Corticium* Fr. has either a smooth hymenium or tubercles arranged in no definite order. It is sub-divided up into two classes, the one having no cystidia, as is the case in *Corticium laeve* Fr., *caeruleum* Fr., *nudum* Fr., *confluens* Fr., and *lactescens* Fr.; and the other having cystidia. These cystidia may be either very short and tender with thin, not granular walls and hyaline contents, as in *Corticium violaceo-lividum* Fr., or very long and occurring over the whole surface, sometimes being fasciculate on irregular protuberances, transversely septate, and having numerous clamp-connections. *Corticium setigerum* (Fr.) Karst. is included in this section, which was formerly referred to the genus *Kneiffia* Fr. Again the cystidia may be swollen up and rugose, sometimes very long, and have thick walls granularly encrusted. This constitutes the genus *Peniophora* Cke. and includes *Corticium cinereum* Fr., *quercinum* Fr., *puberum* Fr., and *giganteum* Fr. Again the cystidia may be either like bladders or stretched out in a point, sometimes containing a coloured granular juice and not reaching the surface of the hymenium. This corresponds with the genus *Cryptochaete* of Karsten, and includes *Corticium versiforme* Fr. and *polygonium* Fr. 3. *Grandinia* Fr. has the hymenium covered with close, round granules. 4. *Acia* Karst. has the hymenium covered with regular unfimbriate teeth, and it includes the resupinate species of *Hydnum* Fr., but Patouillard, notwithstanding this definition of *Acia*, places *Acia Barba-Jovis* (With.) thereunder. And 5 *Radulum* Fr. has the hymenium covered with obtuse and deformed tubercles. The STEREA are divided into three genera, the first two of which have an entire, smooth or radiate hymenium. In 1 *Podoscypha* Pat. the species are upright, with either a central or lateral stem, and he places thereunder *Podoscypha Sowerbeii* (Berk.) Pat. In 2 *Stereum* Fr. the plants are sessile or inserted by a stem-like constriction, and in 3 *Cladoderris* Pers. the hymenium is folded like a fan.

The PORI are separated into four groups, the first two of which have the tubes joined together, and the orifice of the tubes is sterile. In the I. POLYPORI the species are fleshy, coriaceous or membranous and have white spores, whilst in the II. FOMES the plants are corky or woody, rarely fleshy and afterwards hard and fibrous. In the III. MERULII the partition walls of the hymenium are obtuse and fertile on the edge, and in the IV. FISTULINAE the tubes are free from one another. The POLYPORI include three series, the first two of which have central or lateral stems and a white trama. If the plants be fleshy they constitute the series EUPOLYPORI, if the plants are fleshy-coriaceous or cartilaginous the LEUCOPORI, and if the plants be either dimidiate or sometimes stipitate, the

LEPTOPORI, but in this latter case the trama is dark coloured. The EUPOLYPORI consist of two genera, 1 *Polyporus* Fr. having regular pores with either entire or toothed dissepiments, and 2 *Sistotrema* Pers. having the pores torn up into little plates, irregularly arranged and anastomosing at the base. *Polyporus* includes *Polyporus ovinus* Fr., *Pes-Caprae* Pers., *leucomelas* Pers., *umbellatus* Fr., *cristatus* Fr., *frondosus* Fr., *giganteus* Fr., and *sulphureus* Bull. The LEUCOPORI include two genera, 1 *Melanopus* Pat. having the base of the stem black and 2 *Leucoporus* Quél. having small pores and elongated tubes, and the following are placed in these two genera: *Melanopus squamosus* (Fr.), *elegans* (Fr.), *varius* (Fr.), *picipes* (Fr.) and *calyculus* (Pat.), and *Leucoporus brumalis* (Pers.), *lentus* (Berk.), and *arcularius* (Fr.). The LEPTOPORI comprise three genera, the first two of which have either a pale or white trama, and if the plants be either spongy or hispid then it is the genus 1 *Spongipellis* Pat. which contains *Spongipellis borealis* (Fr.) and *spumeus* (Fr.). If the plants be at first fleshy then subsequently hard and either glabrous or villose, it is the genus 2 *Leptoporus* Quél., and he places thereunder *Leptoporus mollis* (Fr.), *chioneus* (Pers.), *caesius* (Fr.), *lacteus* (Fr.), *stypticus* (Fr.), *destructor* (Fr.), *molluscus* (Fr.), *Vaillantii* (Fr.), *adustus* (Fr.), *amorphus* (Fr.), and *fumosus* (Fr.) (= *salignus* Fr.). *Leptoporus* is easily distinguished from *Coriolus* Quél. by the tubes being distinct from the hymenophore. If the plants have a deeply coloured trama they belong to the genus *Phaeolus* Pat. which contains *Phaeolus Schweinitzii* (Fr.), *spongia* (Fr.), and *nidulans* Pers. The FOMES consist of three series. The TRAMETES have the tubes hollowed out of the trama which does not form a distinct layer, whereas in the other two series the tubes constitute a layer distinct from the hymenophore. The IGNIARII have the surface of the pileus velvety and destitute of a crust at least when young. The PLACODES have the surface of the pileus furnished with a rigid crust. The TRAMETES comprise three genera. 1. *Lenzites* Fr. has the hymenium arranged on gills, and it includes in addition to the usual species ranged thereunder *Lenzites quercina* (Bull.) and *confragosa* Bull. The hymenium in the other two genera is hollowed out into small equilateral pores with a homogeneous trama. In 2 *Trametes* Fr. the plants are generally thick and are either glabrous or villose. It contains in addition to the species generally placed here *Trametes bombycina* (Pat.), *mollis* (Fr.), *aneirina* (Fr.), *obducens* (Fr.) and *medulla panis* (Fr.) In 3 *Coriolus* Quél. the plants are thin. It embraces *Coriolus versicolor* (Pers.), *hirsutus* (Fr.), *velutinus* (Fr.), *abietinus* (Fr.), *obliquus* (Fr.), and *armenicolor* (Berk.). The IGNIARII contain three genera, the first two of which have white spores. 1. *Phel-*

linus Quél. has regular equilateral pores, and the following species are cited: *Phellinus salicinus* (Fr.), *igniarius* (Fr.), *nigricans* (Fr.), *gilvus* (Schw.), *dryadeus* (Fr.), *ferruginosus* (Fr.), and *contiguus* (Fr.). 2. *Hymenochaete* Lév. has the surface of the hymenium bare without either pores or points with the exception of the fawn coloured cystidia, and 3 *Xanthochrous* Pat. is characterized by its yellow spores and figured and variable hymenium. It comprises *Xanthochrous perennis* (Fr.), *cinnamomeus* (Fr.), *Montagnei* (Fr.), *connatus* (Schw.), *hispidus* (Fr.), *cuticularis* (Bull.), *rheades* (Pers.), *radiatus* (Fr.), *nodulosus* (Fr.), *conchatus* (Fr.), *ribis* (Pers.), and *Euonymi* (Kalchb.). The PLACODES include two genera, 1 *Ungulina* Pat. having the orifice of the pores bare, white spores and consisting of species of large size, and 2 *Ganoderma* (Karst.) Pat. having coloured spores. The following species are arranged under these two genera *Ungulina fomentaria* (Fr.), *annosa* (Fr.), *betulina* (Fr.), *benzoina* (Fr.) and *Quercina* (Fr.), and *Ganoderma lucidum* (Leyss.), *resinaceum* Boud. and *applanatum* (Pers.). The MERULII comprise five genera, of which the first three have white spores 1. *Merulius* Fr. is of a more or less gelatinous consistency and the folds of the hymenium anastomose in irregular hollows. It contains the following species: *Merulius corium* Fr., *tremellosus* Fr., *aureus* Fr., *molluscus* Fr., *pallens* Berk., *porinoïdes* Pers., *rufus* Pers., *serpens* Fr. and *umbrinus* Fr. 2. *Phlebia* Fr. is of a waxy-firm nature and the radiating folds of the hymenium do not anastomose or become tubercular, and under *Phlebia aurantiaca* (Sow.) Karst. Patouillard makes the species hitherto known as *Phlebia merismoides* Fr., *radiata* Fr. and *contorta* Fr. identical as synonyms but to my mind the last species is clearly distinct from the other two, which may possibly be only forms of one species. 3. *Plicatura* Peck is of a coriaceous spongy consistency with gill-like crisped folds. It includes *Plicatura faginea* Karst., which is more generally known as *Trogia crispa* Fr., though the definition of *Trogia* Fr. is in this work reserved for tropical species of CANTHARELLI. The last two genera of the MERULII have coloured spores. 4. *Gyrophana* Pat. is of a firm, gelatinous consistency with the folds of the hymenium anastomosing in irregular hollows, and is really the counterpart of *Merulius* with coloured spores, and includes *Gyrophana lacrymans* (Jacq.) and *pulverulenta* Fr. And 5 *Coniophora* DC. is of a waxy consistency, with smooth hymenium, and is well represented by *Coniophora puteana* Fr. The genus *Ptychogaster* Cda. is merely the conidial form of various genera of PORI, and the so-called genera *Irpex* Fr. and *Poria* Fr. are merely degenerate forms of the same family. The HYDNA are characterized by having points or spines on the inferior

surface of the receptacle, and these together with the intervening spaces are covered by the hymenium. They are separated into three series, I. the MUCRONELLAE, which have no receptacle, and the whole plant consists of needle-like teeth. This series is represented by one genus, *Mucronella* Fr., and the old Friesian species are assigned to it. II. The HYDNA are made up of fleshy, cheesy or membranaceous species and are divided into three genera with white spores. 1. *Hydnum* Fr. consists of fleshy plants. It includes *Hydnum repandum* Fr., *rufescens* Pers., *Erinaceus* Bull., *Caput Medusae* Bull., *coralloides* Schaeff., *Notarisii* Inz., *alpestre* Fr., *mucidum* Pers. and *septentrionale* Fr. 2. *Pleurodon* Quél. embraces species of a leathery consistency, with lateral stem and round spores. It is represented by *Pleurodon auriscalpium* (Fr.). 3. *Mycoleptodon* Pat. comprises coriaceous plants, dimidiate in shape, rarely stipitate, and having oval spores. It includes *Mycoleptodon pudorinum* (Fr.), *ochraceum* (Pers.), *strigosum* (Swartz.) and *pusillum* (Brot.). And III. The PHYLACTERIAE consist of fleshy species with a coloured trama and having either rough or angular brown spores. They are divided into four genera, the first three of which are either stipitate or sessile and dimidiate, and in the first two the hymenial surface is toothed. 1. *Sarcodon* Quél. is made up of fleshy species and contains *Sarcodon imbricatum* (Fr.), *amarescens* Quél., *squamosum* (Fr.), *acre* Quél., *fuligineo-violaceum* (Kalchb.) and *fusipes* (Pers.). 2. *Calodon* Quél. includes coriaceous species such as *Calodon amicum* Quél., *velutinum* (Fr.), *zonatum* (Batsch), *scrobiculatum* (Fr.), *caeruleum* (Fl. Dan.), *aurantiacum* (A. & S.), *cyathiforme* (Schaeff.), *nigrum* (Fr.), *ferrugineum* (Fr.), and *geogenium* (Fr.). 3. *Phylacteria* Pers. is represented by leathery plants with either a radiately wrinkled or tubercular hymenium. It comprises *Phylacteria terrestris* (Ehr.), *palmata* (Scop.), *laciniata* Pers., *anthocephala* (Bull.), *diffusa* (Fr.), *caryophyllea* Pers., *atrocitrina* Quél., and *intybacea* Pers. 4. *Caldesiella* Sacc. has resupinate plants of a soft floccose nature with floccose teeth and brown or yellowish, verrucose or rough spores. It contains *Caldesiella ferruginosa* (Fr.), *viridis* (A. & S.) and *vaga* (Fr.) (= *Phlebia vaga* Fr.).

The AGARICACEAE are divided into three tribes. I. The BOLETI have a porous hymenium, soft and easily separable from the pileus, whereas in the other two tribes the hymenium is homogeneous and inseparable from the pileus. II. The CANTHARELLI have the hymenium spread out on folds; and III. The AGARICI have the hymenium on gills. The BOLETI are naturally connected with the AGARICACEAE by the presence of a universal veil, which is either fugacious or remains as a ring on the stem and by the simultaneous develop-

ment of the hymenial elements. These two characters separate this tribe from the PORI, which are gymnocarps and develop their tubes successively in an indefinite manner. The BOLETI are arranged in two series, the BOLETI having a porous hymenium and the PAXILLI possessing a gill-like hymenium. The genera of BOLETI are divided into five, based on the colour of the spores of the species placed in each. 1. *Gyroporus* Quél. has white spores and includes *Gyroporus castaneus* (Bull.), *cyanescens* (Bull.), *albus* (Gillet), and *fulvidus* Fr. 2. *Tylopilus* Karst. possesses pink spores and is represented by *Tylopilus felleus* (Bull.). The three other genera have ochraceous or ferruginous spores. 3. *Strobilomyces* Berk. has a fleshy coriaceous receptacle and the surface of the pileus is covered with imbricate scales. In the last two genera the receptacle is fleshy and soft and the pileus is either smooth, glabrous or villose. In 4 *Gyrodon* Opat. the tubes are very short and contorted. It embraces *Gyrodon rubescens* (Trog.), *lividum* (Bull.) and *Sistotrema* (Fr.). In 5 *Boletus* Dill. the tubes are long and the species enumerated thereunder consist of those that have not been withdrawn from this genus as previously understood. The PAXILLI are separated into two genera, 1 *Phylloporus* Quél. having the margin of the pileus straight or slightly incurved, and 2 *Paxillus* Fr. having the margin inrolled. The type species of *Phylloporus* is *Phylloporus paradoxus* (Kalch.) Quél., which has been described in various systematic works as *Agaricus rhodoxanthus* Schw., *Agaricus Tammii* Fr. Monogr. II. 301. *Agaricus Pelletieri* Lév. in Crouan Fl. Finist., *Agaricus paradoxus* Kalch. Ic. Hung. t. 16 f. 1. *Paxillus flavidus* Berk. Dec. n. 116, *Clitocybe Pelletieri* Gillet Champ. 170, *Gomphidius rhodoxanthus* Sacc. Syll. v. 1139, *Paxillus Tammii* Pat. Tab. anal. n. 354, *Phylloporus Pelletieri* Quél. Fl. Myc. 409, and *Flammula vinosa* Cke. Illus. t. 437.

The CANTHARELLI are separated into six genera, five of which have white spores. 1 *Nyctalis* Fr. and 2 *Cantharellus* Fr. have fleshy receptacles, in the former the gills are simple whilst in the latter the gills are forked and the basidia have four, five, six or eight sterigmata. 3 *Craterellus* Fr. possesses a veined or smooth hymenium and the species contained therein are either umbilicate or infundibuliform. 4 *Arrhenia* Fr. and 5 *Dictyolus* Quél. have delicate thin receptacles, in the former the stem is lateral and the hymenium is either smooth or simply wrinkled, and Patouillard cites as the type of this genus *Arrhenia auriscalpium* Fr. In the latter the hymenium is either reticulate or folded, or smooth, and includes *Dictyolus spathulatus* (Fr.), *muscigenus* (Bull.), *retirugus* (Bull.), *lobatus* (Pers.), *applicatus* (Lév.), *cupularis* (Wnbg.) and *tenellus* (Fr.).

The sixth genus *Neurophyllum* Pat. has ochre or brown spores and the type of the genus is well represented by *Neurophyllum clavatum* (Pers.), a species that was formerly included in *Craterellus*.

The AGARICI Patouillard arranges in three groups, based on the character of the spore. In the first group the walls of the spore are continuous, in the third the walls of the spore show a germinating pore at the apex, and in the second group certain species having ochraceous spores include both species with spores having continuous cuticles and those having a germinating pore, and examples of this second group occur in the genera *Pholiota* Fr., *Naucoria* Fr. and *Galera* Fr. The first group he divides into eleven series. 1. The LENTINI consist of woody species having white spores. 2. The MARASMII comprise firm membranaceous plants that are not putrescent but revive again with moisture and have white spores. 3. The COLLYBIAE are Agarics with white spores, non-decurrent gills and cartilaginous stem, that decay and do not revive again in wet weather. 4. The PLEUROTI are fleshy coriaceous Agarics either resupinate or sessile and dimidiate, either with an excentric or lateral stem and have various coloured spores. 5. The LACTARII are known by the vesicular, short, rounded cells that traverse the trama and stem and they are accompanied by other cells containing either a coloured or uncoloured fluid (the latex) and their spores are echinulate and round, they really have no affinity with any other series. 6. The HYGROPHORI are terrestrial Agarics, of a fleshy-waxy consistency, with a ringed or ringless stem which is a little enlarged into the orbicular pileus, which is either dry, viscid, glabrous or villose, and they have soft, distant gills which are either deeply decurrent or broadly adnate with a decurrent tooth and bear either white or black spores. 7. The OMPHALIAE are fleshy, putrescent Agarics, generally terrestrial, and have a central, ringless stem, the pileus round, umbilicate at first, then infundibuliform, decurrent gills and white spores either smooth or rough. 8. The TRICHOLOMATA have white spores, confluent fleshy stem and pileus and sinuate gills. All possess originally a general veil which disappears in the adult condition or persists as a ring upon the stem. 9. The GONIOSPORAE are made up of Agarics having angular pink spores and confluent stem and pileus. 10. The CORTINARII are fleshy Agarics having the flesh of the stem and of the pileus confluent, white or ochraceous spores, and are characterized by a general filamentous veil which is either fugacious or persists in the form of a more or less arachnoid ring. 11. The AMANITAE comprise Agarics having the stem distinct and easily separable from the pileus and the spores are of various colours. The second and third groups are

arranged in one series each, The PHOLIOTAE, consisting of Agarics with a central stem, the flesh of which is confluent with the flesh of the pileus and having either a membranaceous ring or being without one, and the PRATELLAE, which possess the characters of the group.

The LENTINI are divided into three genera, the first two of which have simple gills and the third has pores. 1. *Panus* Fr. has a fleshy coriaceous pileus and relatively soft gills, whilst 2, *Lentinus* Fr. has a woody, pliant pileus and dry gills. This genus, as defined by Fries, was limited to species having the edge of the gill serrated or torn in a toothed manner, but botanists who have studied fungi coming from all parts of the world do not consider that the genus can be so restricted in its limitations. 3. *Favolus* Fr. has large, honeycomb-shaped pores with thin walls and the species are coriaceous. It includes the well-known *Favolus europaeus* Fr. which has generally been ranged under the POLYPORACEAE. The MARASMII Patouillard arranges in two divisions, based on the factor whether A the pileus has a pellicle with thick walled cells or B the pileus is either without a distinct pellicle or the pellicle consists of thin walled cells. A is further divided into α, where the cells of the pellicle are upright, verrucose or smooth, and have a brush-like appearance, and β where the cells of the pellicle are recumbent, very long and hair like. Under the division A.α is placed the genus *Androsaceus* (Pers.) Pat. having gills, and he includes thereunder *Androsaceus calopus* (Fr.), *polyadelphus* (Lasch.), *rotula* (Fr.), *Hudsoni* (Berk.), *epiphyllus* (Fr.), and *buxi* (Fr.). Under the division A. β is located the genus *Crinipellis* Pat., which also is characterized by having a lamellar hymenium, and is only represented in our British Fungus Flora by *Crinipellis stipitarius* (Pers.), a species that has been generally assigned to *Collybia*, but which is clearly one that belongs to *Marasmius*. In division B the true *Marasmii* are collected together, it includes the genus *Marasmius* Fr., which is characterized by a membranaceous stem and pileus with gill-like hymenium, and comprises the following species:—*Marasmius urens* (Bull.), *oreades* (Bull.), *erythropus* (Pers.), *foetidus* (Sow.), *amadelphus* Bull., *ramealis* Bull., *cauticinalis* (With.), *alliaceus* Fr., *scorodonius* Fr., *chordalis* Fr., and *splachnoides* Fr. The COLLYBIAE are arranged in three genera, the first two of which have the margin of the pileus involute. 1. *Mucidula* Pat. is characterized by its soft almost gelatinous consistency and the large basidia and spores. It includes the well-known *Mucidula mucida* (Fr.) that has generally been placed under the genus *Armillaria*. 2. *Collybia* Fr. consists of fleshy species having small basidia and spores. It comprises in addition to those species put in

this genus by Fries the whole of his *Collybiae annulatae* section of *Armillaria* with the exception of *Mucidula mucida* (Fr.). 3. *Mycena* Fr. has the margin of the pileus appressed to the stem. The PLEUROTI contain five genera, the first three of which have white spores. 1. *Schizophyllum* Fr. is made up of coriaceous species having the gills split longitudinally. 2. *Calathinus* Quél. comprises species of small size which have small round spores. It includes *Calathinus hypnophilus* (Berk.), *striatulus* (Fr.), *limpidus* (Fr.), *mastrucatus* (Fr.), *dictyorhizus* (DC.) and *septicus* (Fr.). 3. *Pleurotus* Fr. consists of plants of large size having cylindrical or oval spores. 4. *Dochmiopus* Pat. has either round or oval pink spores and the species constituting this genus are small in size, such as *Dochmiopus variabilis* (Pers.), *sphaerosporus* Pat. and *macrosporus* Pat. 5. *Crepidotus* Fr. possesses ochre or ferruginous spores and includes *Crepidotus palmatus* (Bull.) and *mollis* Schaeff. The LACTARII are divided up into two genera. 1. *Lactarius* Fr. having opaque, abundant milk, which flows away when the plant is wounded, and 2, *Russula* Pers., having watery, sparse milk, which is not so apparent when the plant is injured. The HYGROPHORI also consist of two genera only, 1, *Hygrophorus* Fr., possessing white spores, and 2, *Gomphidius* Fr., possessing black spores but in my opinion *Gomphidius* is more nearly related to *Boletus* Dill. by reason of its spindle-shaped spores. The OMPHALIAE embrace six genera, the first four of which have smooth spores. 1, *Clitocybe* Fr., and 2, *Armillariella* Karst., have the flesh of the stem and of the pileus of the same consistency and comprise species generally of large size. In the former genus there is no ring but in the latter there is a ring, and it includes *Armillariella mellea* (Vahl.), *dryina* (Pers.), and *corticata* (Fr.). 3. *Omphalia* Fr. is confined to species of small size having a membranaceous pileus and cartilaginous stem. 4. *Delicatula* Fayod is characterized by its narrow, fold-like, almost absent gills, and comprises *Delicatula integrella* (Pers.), *crispula* (Quél), *microscopica* (Wirtgen), and *echinipes* Fr. The remaining two genera have rough spores. 5. *Lepista* Fr. has thin, crowded gills bearing small, verrucose spores, and includes *Lepista flaccida* (Sow.), *gibba* (Pers.), *inversa* (Scop.) and *maxima* (Fr.). 6. *Laccaria* B. & Br. has thick, distant gills with large spores and comprises *Laccaria laccata* (Scop.), *proxima* (Boud.) and *tortilis* (Bolt.), but René Maire has lately shown in the Bulletin de la Société Mycologique de France, vol. xxiv., p. lv., that *proxima* is only a variety of *laccata* having elliptical spores instead of globose spores, and that both form of spores can be found on one and the same specimen. The TRICHOLOMATA are divided up into three genera. 1. *Armillaria* Fr. has a ring on the stem and includes *Armillaria aurantia*

(Schaeff.), *colossa* (Fr.), *caligata* (Viv.), *robusta* (A. & S.) and *verrucipes* Fr. 2, *Tricholoma* Fr., and 3, *Melanoleuca* Pat., have no ring on the stem, but the spores in the former are smooth whilst in the latter they are rough, and it includes *Melanoleuca vulgaris* Pat. (= *Tricholoma melaleucum* Fr.), *humilis* (Fr.), and *brevipes* (Pers.). The GONIOSPORAE are placed following Quélet in one genus *Rhodophyllus* Quél., and are sub-divided into the five sub-genera, *Claudopus* Worth. Smith, *Nolanea* Fr., *Leptonia* Fr., *Eccilia* Fr., and *Entoloma* Fr. Patouillard next interpolates the genus *Clitopilus* Fr., which he defines as being made up of species having fusiform, longitudinally ribbed spores like *Clitopilus Orcella* (Bull.) and *mundulus* (Lasch.), but I fail to see why this genus is placed under his series of GONIOSPORAE. The CORTINARII are arranged under four genera. 1. *Cortinellus* Roze has white spores and a bulbous stem and includes *Cortinellus bulbiger* (Fr.) Gillet. The remaining genera possess ochraceous spores. 2. *Cortinarius* Fr. has an arachnoid general veil which is distinct from the epidermis of the pileus, and Patouillard sub-divides them into the usual sub-genera with the exception of *Dermocybe* Fr., the species of which he follows Quélet in transferring to the sub-genus *Inoloma* Quél. 3, *Inocybe* Fr., and 4, *Hebeloma* Fr., have no distinct general veil, but the margin of the pileus is fibrillose, in the former the gills are more or less widely adnate whereas in the latter they are sinuate. *Inocybe* is separated into two sub-groups, the *Levisporae*, which include *Inocybe Trinii* (Wein.), *Jurana* Pat., *corydalina* Quél., *rimosa* (Bull.), *pyriodora* Pers., and *geophylla* (Sow.), and the *Angulisporae*, which include *Inocybe scabella* Fr., *calospora* Quél., *asterospora* Quél., *lanuginosa* (Bull.), *tricholoma* A. & S., and *strigiceps* Fr. The cortina is fugacious and fibrillose in *Hebeloma versipelle* Fr., *mesophaeum* Fr., *crustuliniforme* (Bull.), and *sinapizans* Fr., whilst it persists as a ring in *Hebeloma strophosum* Fr. The AMANITAE are separated into seven genera. 1. *Locellina* Gillet has ochraceous spores, a volva, but no ring, and *Locellina acetabulosa* (Sow.) is cited as an example of this genus, but it is more probable that Sowerby's figure represents an *Inocybe* near to *Inocybe asterospora* Quél. The next three genera have pink spores. 2. *Volvaria* Fr. possesses a volva but no ring. 3. *Annularia* Schulz. has a ring but no volva, and 4, *Pluteus* Fr., is without a ring and volva. The remaining three genera have white spores. 5. *Schulzeria* Bres. has neither ring nor volva, 6, *Lepiota* Fr., has a ring but no volva, and 7, *Amanita* Pers., has a volva and is either with or without a ring. Patouillard removes from the genus *Lepiota* all species with a spore having a germinating pore and places them in the genus *Leucocoprinus* Pat. in his series of the PRATELLAE.

The PHOLIOTAE are arranged in six genera, the first two of which have membranaceous rings. 1. *Rozites* Karst. has a general veil which persists on the pileus and rugulose spores. It includes *Rozites caperata* (Pers.) Karst., which was formerly classed under *Pholiota*. 2. *Pholiota* Fr. possesses either no general veil or a fugacious one and smooth spores. The four remaining genera have no ring. 3. *Flammula* Fr. has a fleshy stem and adnate or decurrent gills. 4 *Naucoria* Fr., 5 *Galera* Fr., and 6 *Tubaria* Worth. Smith have cartilaginous stems; in the two former the gills are adnate but the margin of the pileus is at the first incurved in *Naucoria*, whilst in *Galera* the margin of the pileus is straight and appressed to the stem, and in *Tubaria* the gills are decurrent.

The PRATELLAE comprise seventeen genera, the first two of which have white spores. 1 *Leucocoprinus* has a ring on the stem and 2 *Hiatula* Fr. is without one. The former genus includes *Leucocoprinus procerus* (Scop.), *excoriatus* (Schaeff.), *rachodes* (Vittad.), *gracilentus* (Krombh.), and *cepaestipes* (Sow.). 3. *Bolbitius* has ochraceous spores and the plants are delicate and of either a yellow or violaceous colour. It comprises *Bolbitius reticulatus* (Fr.) (=*Pluteolus reticulatus* Fr.), *vitellinus* (Pers.), and *luteolus* (Lasch.). The next ten genera have purple spores. 4 *Chitonia* Fr., 5 *Agaricus* (Linn.) Karst., and 6 *Pilosace* Fr. have the flesh of the stem and pileus distinct and separable from each other. *Chitonia* is characterized by its membranaceous volva, *Agaricus* by the possession of a ring but without a volva, and *Pilosace* is destitute of both a ring and a volva. In the remaining genera the flesh of the central stem and pileus is confluent and inseparable. 7. *Stropharia* Fr. has a membranaceous ring, but the rest have either no ring or the ring is arachnoid. 8. *Lacrymaria* Pat. has verrucose spores and includes *Lacrymaria lacrymabunda* (Pers.), *velutina* (Pers.), and *phlebophora* Pat. 9 *Nematoloma* Karst., 10 *Hypholoma* Fr., 11 *Psilocybe* Fr., 12 *Psathyra* Fr., and 13 *Deconica* Worth. Smith have smooth spores. *Nematoloma* is made up of fleshy coriaceous and pliant species and comprises *Nematoloma sublateritium* (Schaeff.), *fasciculare* (Huds.), and *epixanthum* (Fr.). *Hypholoma, Psilocybe, Psathyra* Fr. and *Deconica* consist of fleshy, fragile species. *Hypholoma* has sinuate gills and *Psilocybe* and *Psathyra* have slightly adnate gills, but in *Psilocybe* the margin of the pileus is at the first incurved and in *Psathyra* the margin of the pileus is straight and appressed to the stem. *Deconica* has either broadly adnate or decurrent gills and includes *Deconica coprophila* (Bull.) and *bullacea* (Bull.). The last four genera have black spores, the first three of which have either a fleshy or membranaceous pileus. 14 *Coprinus* Fr. consists of deliquescent species, whilst 15

Panaeolus Fr. and 16 *Psathyrella* Fr. contain species that do not deliquesce. *Panaeolus* has a smooth pileus and variegated gills and *Psathyrella* has a striate pileus but the gills are not variegated. 17. *Montagnites* Fr. has no pileus and the gills are inserted at the apex of the stem, but I feel inclined to agree with Hollós *die Gasteromyceten Ungarns*, pp. 22, 25, who considers that this genus belongs to the GASTEROMYCETAE Willd. and should be placed in the family SECOTIACEAE Hollós.

It will thus be seen from this brief review that many species which are superficially alike are really readily separable into distinct genera belonging to very different groups when attention is paid to the form of their basidia and spores, whilst the position of many other allied species is confirmed by this investigation.

With regard to *Dochmiopus variabilis* (Pers.) it is curious to note that our member Monsieur René Maire in "*Contributions à l'étude de la flore mycologique de l'Afrique du Nord*" in the *Bull. de la Soc. Bot. de Fr.*, t. 7, p. 210, under *Dochmiopus sessilis* (Bull.) Karst., the name which he adopts for this species, says that the spores are warted $5\text{-}7 \times 3\text{-}4\mu$, generally $6 \times 3\mu$, which accords with my own measurements, though I failed to observe that they were warted. He further says: "The spores of this fungus have been generally badly described and figured. Patouillard in his *Hyménomycetes d'Europe*, pl. II., fig. 26, gives the best figure that we know; the form of the spore is well represented but the membrane is shown smooth, no scale is given so we are unable to note its measurement. The figure in the *Tabulae Analyticae* by the same author, No. 225, is not so good; the spores are too small ($3\text{-}4\mu$ long) and their membrane is always figured smooth. It is the same in *Cooke's Illustr.* t. 371 (344). Massee in his *British Fungus Flora II.*, 235, describes the spores as elliptical, smooth, $3 \times 2\mu$. *Britzelmayr, Hyporhod*, 41, figures a neighbouring species with curved spores, which he has since named *Claudopus odorativus* Britz. The figure 419 (*Dermini*) of this author represents a variety with almost glabrous pileus and the spores are figured smooth, $6 \times 3\mu$. We possess an unpublished figure of Britzelmayr representing *D. variabilis* showing straight spores $8 \times 4\mu$, that is to say a little larger and entirely smooth. Another figure by the same author (*Hyporhodii*, 185) gives the same facts. *Saccardo Syll. V.*, 733, gives also exactly the description of the spores "*sp. ellipsoideis* $6\text{-}7 \times 2{\cdot}5\text{-}4\mu$ *pallide rubiginosis*," but does not mention the warts. Quélet, *Flore Mycologique*, p. 76, describes the spore "ellipsoïde, $8\text{-}10\mu$, fauve." Karsten, *Mycologia fennica* II., p. 112, gives as the dimensions of the type spores $9\text{-}14 \times 5\text{-}8\mu$. He adds that he has found a form with smaller spores, $6 \times 3\text{-}4\mu$ but does not mention the warts of the membrane.

Winter, *Die Pilze*, p. 705, gives, following Karsten, the description of the form with large spores of that author. Fayod, *Prodrome d'une Histoire naturelle des Agaricines*, *Annales des Sciences Naturelles, Botanique* 1888, p. 390, describes the spore of a fungus which he identifies as the form with small spores of *Claudopus variabilis* (Pers.) Karst. *Myc. fennica*, p. 112-113. This spore is fusiform, truncate at the top with "8 côtés quasi-équidistants" (*sic*) (8 côtes quasi-équidistantes) (Cf. Pl. 6, fig. 5 m), and they thus resemble those of *Clitopilus Orcella.* This spore Fayod made characteristic of a new genus *Octojuga* and *Dochmiopus variabilis* he transfers into *Octojuga variabilis* (Pers.) Fayod. Hennings, in *Engler and Prantl*, *Pflanzen familien*, I. 1**, p. 254, describes this fungus under the name *Hyporhodius variabilis* (Pers.) Henn.; he gives an original drawing and describes the spores as elliptical, 9-14 × 5-8μ (dimensions based probably on Winter) but he takes no notice of the warts. Lastly, Fayod, in his unpublished drawings, which we have been able to examine at the Botanical Herbarium of Geneva, by the kindness of Monsieur Briquet, represents and describes exactly the fungus under the name *Claudopus variabilis* but the spores are always represented as smooth. Their dimensions 6 × 4μ and 5-6 × 3μ are clearly those of *D. sessilis.* We have been unable to find *Octojuga variabilis* in the collection of drawings by Fayod. The figures labelled *Claudopus variabilis* and *byssisedus* are in a wrapper bearing on the back in the handwriting of Fayod the label *Octojuga.* Did Fayod make a mistake in describing the spore of *D. sessilis* as having eight longitudinal ribs and did he subsequently discover his error? The exactness with which this author has described the spore of *Clitopilus Orcella* with six ribs makes this hypothesis very difficult. In presence of these contradictory descriptions of the writers, which agree only as to the character of the membrane of the spore which is considered by all as smooth, if one excepts Fayod, we were concerned to find out if our specimens from Greece and Algiers did not belong to a different species. In order to confirm us we have examined the specimens of *Dochmiopus sessilis* which occur in France; especially specimens from the herbarium of Godron determined by Montagne, number 407 of *Desmazières Cryptogamic plants* and examples in the herbarium of the Museum determined by Tulasne. We have found exactly the same warted spores and dimensions as in the Grecian and Algerian specimens. We think then that it is necessary to consider as the type of the species the form having elliptical spores with warted membrane from 5-7μ long by 3-4μ wide, being the *D. sessilis var. microsporus* Karst., *Finl. Basidsv.* 71. Karsten's form with large spores remains for investigation as also the *Octojuga* of Fayod. The warts on

the membrane can be seen with a No. 7 Leitz dry objective and No. 2 eye-piece, but they are much more clearly seen with a one-sixteenth immersion objective. It is probable that most of the authors who have studied these spores have examined them too feebly magnified or with an insufficient objective, so that they have not observed the warts." I can confirm Monsieur René Maire, as I have several times examined the ripe spores of *D. variabilis* with a Zeiss J water objective and I have always failed to find any indication of any ribs as described by Fayod. When I say ripe spores I wish to heartily support our member Mr. A. D. Cotton, who in his last contribution to our Transactions, at p. 30, vol. III., "*On further notes on British Clavariae*" says "the spore measurements given are taken from spores that have been shed in the form of a spore print, and not directly from the plant." This is a method we have always adopted, that is my wife and self, for the past twenty years. Our spore maps are always deposited on black paper and the colour of the magnified spore placed on the illustration is the colour that the spore map suggests, not that which appears through the microscope, which I maintain varies when one uses an achromatic or apochromatic microscope or works with day-light or artificial illumination. All these factors then have to be taken into account, but as regards illumination I have for permanent records only worked with day light. It is probable that some of the measurements and shapes of the spores that are so very differently recorded for one and the same species in our books would not suffer so greatly in this respect if the basis on which I have always worked were adopted universally for the HYMENOMYCETAE. It is acknowledged I believe that many ripe spores disclose no septation, but that this is only to be observed just before or after germination has commenced, and this is certainly true for some species of *Calocera* Fr. On the other hand, I have often observed that the ripe ascospores of *Leotia lubrica* Pers. were septate and was somewhat astonished to find that Massee in his *British Fungus Flora*, p. 470, defines the genus as having "spores continuous or one-septate," but it is only *Leotia acicularis* Pers. that he makes ultimately one-septate the spores of *Leotia lubrica* being described as continuous, and Phillips in *British Discomycetes* makes no mention of any septation, although they are accurately represented as one-, two- and three-septate in Greville's *Scottish Cryptogamic Flora*, pl. 56, and this is confirmed by Boudier in his recent *Discomycetes d'Europe*, p. 89, where he defines *Leotia* Pers. as having continuous and later on septate ascospores. I am inclined to agree with our member Mr. Angus Grant that weather conditions greatly effect the appearance of spores in the CLAVARIACEAE and some other genera of a similar build so

that they may appear turbid and granular in wet weather and nearly smooth under drier conditions. The colour of the mature spore is another very valuable character and should be noted as deposited in mass on black paper. *Pleurotus subpalmatus* Fr. Quélet makes synonymous with *Pleurotus palmatus* Bull. and it has really pink spores. Fries, in his *Hymenomycetes Europaei*, p. 168, takes no notice of the colour of the spores of this species, so we must assume that he considered that they were white by placing it in the genus *Pleurotus* Fr. This view is confirmed at p. 275, where he says, under *Crepidotus palmatus* Bull., "Cum *A. subpalmato* confusus, sed sporis ferrugineis distans," and this separation of the two species is maintained by Massee both in his *British Fungus Flora*, vol. II., p. 117, and *European Agaricaceae*, p. 201, in the latter of which he adds spores subglobose 10μ for *palmatus*, although he gives no shape or dimensions of the spore for *subpalmatus* in either work. Quélet rightly describes the spore in his *Flore Mycologique*, p. 274 as "spore sphérique, 7μ, finement grenelée, jaune paille," but this difference in colour is due to the fact that Quélet describes the colour of the spore as seen by transmitted light on the stage of the microscope. When some mycologists appreciated the fact that the colour of the spores was really pink then they erroneously placed this species in two genera, calling it either *Pluteus phlebophorus* Ditm. var. *reticulatus* Cke. or *Entoloma Cookei* Rich. I am confident that all these forms constitute but one species and am confirmed in this view by Boudier in our *Transactions for 1906*, vol. II., p. 153. The importance of the colour of the mature spore as obtained from spore maps has been fully brought home to me on other occasions. Last year our member Mr. Charles Crossland brought to the Newcastle-upon-Tyne foray a beautiful and exact painting of what we British mycologists have been accustomed to call *Paxillus paradoxus* (Kalch.) Cke., but which we have seen Patouillard considers Quélet has placed more correctly in the genus *Phylloporus* Quél. This painting Mr. Crossland considered represented a new and undescribed *Cantharellus* Fr. because the spores were hyaline and had been found by him on the basidia when the gills were pressed down under a cover glass on a glass slip on the stage of the microscope. Luckily I had brought up to the meeting my wife's illustration of a mature specimen and he was at once convinced that I was right in my determination and that the ripe spores were really ochraceous. *Lepiota haematosperma* (Bull.), which includes *Lepiota echinata* (Roth.), has also been the subject of much controversy because of the colour of its ripe spore, but this seems to be due to the fact that the spore when first deposited in mass is almost colourless, but later on becomes of a deeper colour. Both Berkeley and Boudier consider the sum general of its characters constitute it a

Lepiota and do not consider that it should be included in such genera as *Inocybe* and *Psalliota.* With regard to the form and size of the spore strange differences occur. In our English text books Massee is the only one to give any note as to the spores of *Agaricus Elvensis* B. & Br. in his *British Fungus Flora*, vol. I., p. 410, he says the spores are elliptic-oblong, $8 \times 4\mu$, but they are nearly round and measure, as I ascertained from specimens brought in at the Epping Forest foray, $5\text{-}6 \times 4\text{-}5\mu$, and this was subsequently confirmed by the magnificent illustration of this species in *Boudier's Icon*, t. I., f. 134, showing the globular spores with apical germ pore. It is the same with the spores of *Armillaria mucida* Fr. which, as I stated in a previous part of my address, Patouillard considers from its gelatinous consistency, voluminous basidia and spores should constitute a distinct genus having for the annulate forms thereof as type *Mucidula mucida* (Fr.) Pat. Massee, in *British Fungus Flora*, vol. III., p. 230, says "spores elliptical, $15\text{-}16 \times 8\text{-}9\mu$," and he repeats this in his *European Fungus Flora Agaricaceae*, p. 17. In Stevenson's *British Fungi*, p. 33, Worthington Smith gives them as $14 \times 17\mu$, but Quélet, in *Fl. Myc.*, at p. 238, makes them spherical $15 \times 18\mu$, which nearly exactly agrees with my own measurements, $15\text{-}17\mu$. I have brought the measurements of this spore forward because I consider it is that of a species the veriest novice could make no error over. In our text books at the present time it is very hard to make out what is really the true character of the spore of *Inocybe scabella* Fr. Massee, in his recent *Monograph of the genus Inocybe* has omitted this species, although on p. 472 he says with regard to *Inocybe rufoalba* Sacc. that it is "allied to *Inocybe scabella*," and notes under *Inocybe fulvella* Bres. on the same page that it is also "allied to *Inocybe scabella*, which differs in having smooth spores." Now this last statement is in direct contradiction to his description of the spores in his *British Fungus Flora*, vol. II., p. 200, where he writes "spores irregular, nodular, $10 \times 7\mu$," and this he practically repeats in *European Fungus Flora Agaricaceae*, p. 155, "spores rough, $10 \times 7\mu$." Now Bresadola in *Fungi Tridentini*, vol. I., p. 82, finds the "sporae laeves, amygdaliformes, flavo-aureae $10\text{-}13 \times 5\text{-}6\mu$," and adds that *Cooke's Illustrations*, pl. 402, and Pat. *Tab. An.*, No. 547, really represent *Inocybe trechispora* Berk. Cooke's plate 402 Massee referred in *Grevillea*, vol. 21, p. 40, to *Inocybe subrimosa* Karst., but he does not seem to adhere to this, because under *Inocybe asterospora* Quél. *Monograph of the genus Inocybe*, p. 465, he says ("Non Cooke, Illus. pl. 402 as stated by Karsten"). Berkeley and Broome record "spores granulated like *Inocybe fastigiata*." Quélet in his *Flore Mycologique*, p. 101, makes the "spore ellipsoïde 8μ, *epineuse*, bistre," and Hennings in *Engler and*

Prantl's Naturliche Pflanzen-familien, vol. I.**, places *Inocybe scabella* in the sub-group *Asterosporina* Schröt, which includes all species of *Inocybe* having angular or star-shaped spores, and the acceptance of this name for a genus thus constituted would I think greatly assist us as denoting that the spores had this form and that the spores of the remaining *Inocybes* were not so characterized.

Van Bambeke, in the *Bulletin de la Société Royale de Botanique de Belgique*, 1906, p. 104, finds that the species of SCLERODERMACEAE are quite easily distinguished by their spore armature when treated with a 35 per cent. solution of caustic potash, and that this character of the spore had been demonstrated by the brothers Tulasne, who had unfortunately attributed the characteristic spores to the wrong species. Van Bambeke divides the Belgian species of *Scleroderma* into two groups, one having *reticulated* spores and the other having *echinulate* spores. The former group consists of two species, *S. bovista* Fr., with large meshes on the spore, papillate at the surface and surrounded by an irregular transparent border, and *S. vulgare* Fr., with smaller meshes on the spore, and these are more closely applied to the endospore so that the transparent border can only be perceived in places. In the latter group, the echinulate group, *S. verrucosum* Pers. has short, blunt teeth, and *S. cepa* Pers. has long, pointed teeth. Boudier, in his *Discomycetes d'Europe*, p. 28, draws attention to the great value that is to be based on the arrangement of the more or less large or numerous oil drops contained in some of the ascospores, and maintains that they are of more importance in the determination of species than the septation of the ascospores, which is only of value when it can be observed in the ascospores in the ripe ascus or in those recently discharged from the same, as this septation often only takes place a short time previous to germination. On these grounds he has created a new genus, *Physomitra* Boud., which he separates from *Helvella* Linn. and *Gyromitra* Fr. *Physomitra* he defines as being thinner than *Gyromitra* and more like *Helvella* or *Morchella* in appearance, the ascospores are not apiculate, generally contain two oil drops only and are rarely septate. In *Gyromitra* the spores are fusiform, apiculate at both ends, and generally possess three oil drops, whereas in *Helvella* the spores are regularly elliptic with a large central oil drop accompanied or not with other granulations. In this new genus Boudier very happily places two species, *Physomitra infula* (Schaeff.) Boud., which was formerly placed in *Helvella* and *Physomitra esculenta* (Pers.) Boud., which has been generally ranged under *Gyromitra*. Our late member Mr. Arthur Lister was so impressed by the similarity of the ascospore characters of these two species that he was inclined to consider them as one species.

NOTE SUR UNE NOUVELLE ESPÈCE DE PSEUDOPHACIDIUM.

Par Em. Boudier.

Avec la planche 4.

Ayant reçu en Mai dernier, de notre zélé collègue et ami, Mr. Carleton Rea une petite mais intéressante espèce de Discomycète *sur Empetrum nigrum* à lui communiquée par Miss Lorrain Smith qui l'avait reçue de Monsieur D. A. Boyd, j'ai pensé devoir en donner ici la description, la croyant nouvelle malgré son aspect extérieur et son habitat rappelant la *Sphaeropezia empetri.*

PSEUDOPHACIDIUM SMITHIANUM.*

Minutum, $0^{mm.}30$ ad $0^{mm.}31$ latum, primo erumpens dein liberum, subturbinatum, extus nigrum, glabrum, marginatum, margine primo dentato, intus cum hymenio olivaceum; Paraphyses simplices, tenues ad apicem vix incrassatæ, non aut ad summam basim divisæ. Thecæ subcylindricæ, inferne paululatim attenuatæ, inoperculatæ, 8-sporæ, 160-170μ longæ, 20μ latæ. Sporæ ellipticæ, apicibus obtusæ, læves, rectæ aut leniter curvatæ, primo guttulis oleosis 1-2μ crassis cum aliis minutissimis numerosis repletæ, dein eguttulosæ, 17-19μ longæ, 10-12μ crassæ, hyalinæ aut pallidæ.

Ad folia *Empetri nigri.* Primo endophyllum dein erumpens et liberum.

Cette petite espèce diffère surtout de ses voisines par ses spores garnies dans le jeune âge de gouttelettes oléagineuses mais qui se résorbent avec l'âge ou la dessiccation. Elle ressemble à *Sphaeropezia empetri* comme aspect, grosseur et habitat, mais ses spores non cloisonnées et ses paraphyses simples au sommet, ne permettent pas de la ranger dans ce genre. Les spores sont quelquefois légèrement colorées et sans guttules, et, dans ce cas, elles semblent prendre une teinte encore plus foncée en vieillissant.

Je me fais un devoir de la dédier à Miss Lorrain Smith, notre aimable collègue qui me l'a communiquée par l'entremise de Mr. Carleton Rea.

*Collected at Kilbirnie, Ayrshire, and other localities (D. A. Boyd), and at Loch Alsh, Rossshire (A. L. Smith).

MYXOBACTERIACEAE.

By A. Lorrain Smith, F.L.S.

The bacteria of this group have been fully described by Thaxter in the Botanical Gazette, June, 1897 and June, 1904; and more recently by Quehl in the Centralbl. Bakt. xvi. pp. 9-34 (1906). Thaxter gives as the characters of the order:—"Mobile rod-like organisms, multiplying by fission secreting a gelatinous base and forming pseudoplasmodium-like aggregations before passing into a more or less highly developed cyst-producing, resting state, in which the rods may become encysted in groups without modification or may be converted into spore masses." They live on decaying organic matter, and, in the cysted condition, are usually of a bright colour. The cysts are usually quite definite forms and are all of them minute objects, the largest being little over 1 mm. in height. Owing to their delicate and almost microscopic nature, they are rarely detected in the open and the large majority of the species observed have developed on laboratory cultures. The single British member of the group, *Myxococcus pyriformis* A.L.Sm., was found on rabbit dung brought from Llanymawddwy, North Wales, and cultivated in the laboratory of the British Museum. A description of the species was published by me in Journ. Bot. Feb., 1901, pp. 69-72. The cysts composed of minute cocci were thickly scattered over the substratum, as minute pear-shaped bodies of a reddish-orange colour, about $\frac{1}{4}$mm. in height. No other record of any species has been made in this country since that date. I have, however, again obtained the same *Myxococcus* on some material—part dung, and part plant debris—that I collected in the woods at Beauly during the Autumn meeting of the Mycological Society. It is entirely similar in form and habit to the previous gathering. A. Quehl has expressed the opinion that the species is probably a form of *Myxococcus rubescens*, a common and somewhat variable species; but the pear-shaped form of the cysts, which is constant in the specimens from such distant localities as Wales and North Scotland, seems to be sufficient to establish the autonomy of *M. pyriformis*. The following is the diagnosis previously published: "Cysts scattered, pear-shaped, minute, varying in size, about $\frac{1}{4}$mm. in height, bright pinkish orange-coloured (becoming brighter-coloured when dry), on a short, gelatinous stalk comprised of cocci, which are irregularly round or somewhat oval, 1-1·5μ in diameter; colonies in the gelatine cultures, colourless or dirty-white, formed of motile rods varying in length up to about $3 \times \cdot 8\mu$.

FIRST RECORD OF TWO SPECIES OF LABOULBENIACEAE FOR BRITAIN.

By Professor R. H. Biffen, M.A.

Stigmatomyces purpureus Thax. On specimens of *Scatella*, collected on the coast of North Cornwall by Mr. C. G. Lamb, Cambridge.

Laboulbenia vulgaris Peyr. On various hosts, chiefly *Bembidium*, Durnford Fen, Cambridge.

The specimens were kindly identified by Professor R. Thaxter.

WHAT IS HYGROPHORUS CLARKII BERK. & BR.?

By M. C. Cooke.

It was during the year 1868 that Mr. J. A. Clark, of Street Somerset, sent to Mr. Worthington G. Smith, some specimens of a grey *Hygrophorus*, of which he made sketches, (dated October 5, 1868), and then forwarded the specimens to the Rev. M. J. Berkeley for determination and description. Afterwards, it is presumed, this species was described in the Annals of Natural History for May, 1873, p. 340, No. 1358, under the name of *Hygrophorus Clarkii* B. & Br., with the following brief and imperfect description:—" Fragile; pileus convex, sub-umbonate, livid-cinereous, viscid, margin even; stem concolorous hollow; gills broad, distant, thick, adnate, white. In woods, October. Gills in large specimens nearly ½inch wide."

It will be observed that no dimensions are quoted and no figure mentioned.

Thus it remained, and no more, apparently, was heard of it, until about 1888, when a figure was published in Cooke's Illustrations of British Fungi, plate 934, fig. A., under this name, and afterwards quoted, with the original description, in Cooke's Handbook of British Fungi, 2nd. Edition 1889, p. 297.

This was assumed, at the time, to be a correct representation of the species in question; but, on what evidence, and by what authority, it is impossible now to discover, as no note can be found, and my memory fails to render me any assistance, but no one could contend that it did not answer to the very meagre

original description. The only addition being a spore measurement, for the first time, possibly from the specimens figured, but afterwards destined to become an additional complication.

Recently it has come to my knowledge that the specimens originally passed through the hands of my friend Mr. Worthington Smith, and he has supplied me with the outline and measurements of the type specimens, which are altogether different from the figure in the "Illustrations," and strengthens the suggestion that the latter is only a form of *Hygrophorus unguinosus*, but certainly not *H. Clarkii* B. & Br.

From these data it is evident that the dimensions of the type specimens were—pileus 4 inches diameter; stem 3 inches long, 1-1¼ inches thick; gills about ½inch broad, and the spores are said to have been $10\text{-}12 \times 6\text{-}8\mu$.

It may be here remarked that Mr. Worthington Smith considers the species, of which he secured the outline, to be synonymous with *Hygrophorus latitabundus* of Britzelmeyer (Hym. Augs. iv., p. 134, fig. 14), and also with the figure given by Kalchbrenner (plate 24, fig. 1), erroneously attributed by him to *Hygrophorus limacinus*.

If we turn to Massee's Fungus Flora, we shall find there another description of *Hygrophorus Clarkii*, to the following effect:—

"Pileus 1½-2 in.; fragile, flesh thin, convex then more or less plane, somewhat unbonate, smooth, margin even, viscid, livid-grey. Gills broadly adnate, with a decurrent tooth, up to 5 lines broad, thick, distant, white. Stem 2-3 inches long, about 2 lines thick, equal, smooth, grey, base white, often slightly bent, hollow. Spores subglobose, smooth $12 \times 10\mu$. Characterized by livid grey stem and pileus, the very broad, distant, adnate gills, and the large subglobose spores."

Who shall decide which is *Hygrophorus Clarkii* Berk & Br., for the above is a second species, or, *Hygrophorus Clarkii* (amended) which may, for convenience sake, be called *Hgyrophorus Clarkii* Massee.

To these may also be added a third, which might be compiled from a combination of Berkeley's description and Smith's figures, which latter are exhibited in the Botanical gallery of the Museum of Natural History at South Kensington, but which we prefer to give in the precise terms in which Mr. Worthington Smith drew up his diagnosis of the species, as derived from the original specimens received by him from Mr. J. Aubrey Clark, and the figures which he executed from those specimens.

"Pileus obtuse, convexoplane, viscid, opaque umber or livid-cinereous; margin even, white. Stem solid, stuffed, or hollow, equal or attenuated downwards, viscid, and white squamulose above, pale umber and scaly below. Gills adnate, distant, broad, thick, veined, ivory white."

"Woods, pastures, Oct., Sept. Pileus $3\frac{3}{4}$ diam. stem $2\frac{5}{8}$in. long, $1\frac{1}{8}$in. thick."

And what should this be called? It cannot be called *Hygrophorus latitabundus* Britz., because that species is as imperfectly described as was *H. Clarkii* B. & Br., let us therefore call it number three.

We have thus the following three species:—

1. *Hygrophorus Clarkii* B. & Br.
2. *Hygrophorus Clarkii* Massee.
3. *Hygrophorus Clarkii* W. G. Smith.

Not to mention—

4. *Hygrophorus Clarkii* Cooke Illustrations, pl. 934, fig. A, which is evidently not *Hygrophorus Clarkii* at all, but, possibly a variety of *Hygrophorus unguinosus.*

What is *Hygrophorus Clarkii* Berk & Br.? And it appears to us, that, unless Worthington Smith's figures be accepted as evidence, we must conclude that "nobody knows," and hence it had better be ignored, as a species, and so—"close the book."

NOTE.—Worthington G. Smith's grim satire on Modern Nomenclature as applied to Hymenomycetal Fungi is lately published under the title of "Synopsis of British Basidiomycetes." It is to be regretted that an otherwise useful work should have to be sacrificed to that demon of humour which presided over Gulliver's Travels. Unfortunately there are students who will be accepting all the "emendations" as of serious intent. Names and authorities are getting so mixed that species will soon have to be known, like convicts, by their numbers. M. C. C.

OMITTED ASCI MEASUREMENTS OF SOME BRITISH DISCOMYCETES.

By Charles Crossland, F.L.S.

Many years ago, Mr. Massee strongly recommended me, when examining fungi of any description, to take careful notes and make sketches of all micro-features possible. This most excellent advice has been followed whenever opportunity and time have allowed; thus a pile of information has accumulated, which, eventually, has enabled me to add numerous details to the diagnoses of many incompletely described species. My attention in this direction has been given mostly to the Discomycetes,

a group of fungi full of fascinating interest, exceeded only, perhaps, by the kindred group—the Pyrenomycetes.

When first I began to make notes and drawings, I established the practice of taking as full a description as lay in my power direct from the specimens themselves, apart altogether from any book information that might have been published respecting them; books were then referred to in the hope of fitting my fungus to some already-described species; if unsuccessful, specimens were submitted to some acknowledged authority. In the determination of species, my principal care has been to make certain, so far as possible, of the identity of the individuals dealt with; this is not always an easy matter to do to your own satisfaction. When there has been room for reasonable doubt, the specimens, drawings and notes, have been laid on one side awaiting further light being thrown upon them. A few are there yet.

The purpose of this paper is to give some of the results of my investigations on the fructifications of British Discomycetes bearing chiefly on the dimensions of the asci, and to supply numerous omissions of asci measurements in the published diagnoses of members in this group. All the figures were taken from living material, and many of them have been checked several times over.

It is only within recent years that measurements of asci have been systematically included in the diagnoses of ascomycetous fungi in this country. In 1897, Mr. Massee gave a valuable series in his "Monograph of the Geoglosseae" (Ann. Bot. xi., pp. 225-306). They are also included in "Researches on Coprophilus Fungi" by Massee and Salmon (l.c. xv., pp. 314-357; xvi., pp. 57-93); in the descriptions of all New and Critical Discomycetes published from time to time, by the writer and others, in "The Naturalist" for many years back; in the Transactions of the British Mycological Society from the first issue onwards; and in the Journal of Botany, and other British publications. Prof. Saccardo included all that were at his disposal during the compilation of his notable work—"Sylloge Fungorum." Continental authors preceded us in this matter, and the Americans have long considered Discomycete diagnoses incomplete that did not include ascus measurements, and doubtless students universally are now of the same opinion.

Notwithstanding this general decision to include the length and thickness of the ascus in the description of a discomycete, there may be room to question whether these characters are of much real assistance in determining critical or closely allied species. Their comparative features are certainly of much less value than those possessed by the spores for the identification of species; yet, the characters of fungi generally are so few

that every ascertainable detail of their structure should be taken note of. They are but the hyaline sacs within which the spores are developed. In shape they range from globose, elliptical, or oblong footless bodies, to clavate, cylindric-clavate, and cylindrical structures with short or long pedicels. In the Discomycetes they are mostly pedicellate, but this begins to disappear in the lower members of the Ascobolaceae.

On taking the dimensions of asci, it is found that what appears to be equally mature asci vary both in length and diameter within certain limits in the same pinch of hymenium. Thus it is necessary to give a maximum and minimum length and width, *e.g.*:—

Rhizina inflata	480-530 × 12-16μ.
Gyromitra esculenta	450-480 × 14-16μ.
Helvella crispa	290-310 × 17-19μ.
Sclerotinia tuberosa	190-200 × 9-10μ.
Helotium virgultorum	100-120 × 8-9μ.
„ *herbarum*	70- 80 × 6-8μ.
Dasyscypha virginea	50- 60 × 5-6·5μ.
Mollisia dilutella	40- 44 × 6-7μ.
Dasyscypha acuum	22- 26 × 4-5μ.

and so on; these approximate dimensions are the best we can hope to get. They vary to the greatest extent, both in length and stoutness, in the Ascobolaceae. This we might expect from their luxuriant method of growth. Take for example, *Ascobolus immersus*—280-360 × 80-120μ.: Rabh. Krypt. Flo. says—600 × 90-105; *Ascophanus carneus*—240-280 × 18-28μ.: Rabh. Krypt. Flo. says—100-200 × 20-30μ. A case of *Lachnea coprinaria* may be cited in which the length of the ascus appeared to detract from the width; in one specimen I found them 180-200 × 24μ; in another 210-300 × 14-16μ. There may be in some cases a certain amount of tension exercised on the ascus immediately prior to the expulsion of its spores; on one occasion I had just measured an ascus of *Bulgaria polymorpha*, when it suddenly shot its spores and as suddenly contracted in length from 220μ-160μ. Pedicels may also vary in length; in a specimen of *Ascobolus Kerverni*, the total length of one ascus was 190μ—body 140μ, pedicel 50μ; in another measuring 150μ the body was 140μ long and the pedicel only 10μ.

One may ask—when are we to know when an ascus has arrived at its mature length? According to my experience the arrangement of the spores in a continuous, single, double, or irregular series in the upper portion of this organ affords the safest evidence of the maturity of both. This does not, of course, apply to acicular spores which are often nearly as long as the ascus in which they are produced.

There has been a lack of uniformity in the methods of students in measuring asci. Occasionally authors have given the length of what they call the spore bearing portion. In many cases the spores, with the active protoplasm forming them, at first fill the whole of the ascus: when mature, they occupy varying lengths of the upper part depending upon whether they are more or less closely arranged. In *Gyromitra esculenta*, the mature spores take up only a little over one-third the space; thus, while the ascus itself measures 450-480μ from the base to the apex, the sporiferous part is 160-170μ. Saccardo says 110-140μ, which is much less than I make it, and I have examined living fructifications of this species for fourteen successive seasons. It is not much more definite to measure what is considered the body of the ascus, and exclude the pedicel; in most cases, it is difficult to tell where the pedicel ends and the ascus body begins. Neither practice appears to me to be as satisfactory as taking the entire length, which has been my custom from the beginning. In clavate or cylindric-clavate asci the width within the walls at the centre of the widest part has been taken as the diameter.

On comparing my measurements with those in Rabh. Krypt. Flo., I find as a rule they run very close, while in many cases they are exactly similar. Occasionally, however, there is a startling difference in the dimensions between us, and that in species which cannot well be confused with others. Take the following. The first column is from Rabh. Krypt. Flo.:—

Geopyxis coccinea	400-500 × 15-18μ.	370-400 × 15-17μ.
Geoglossum viscosum	88-110 × 11μ.	240 × 12-14μ.
Otidea aurantia	250 × 10-12μ.	190-200 × 11μ.

I must leave others interested to settle between the two.

Variable as these structures are in the Discomycetes, they are more so in the Pyrenomycetes. The late Mr. F. Currey in the introduction to his work "On fructifications of Sphæria" (Linn. Soc. Trans. xxii.) remarks "The shape of the ascus varies so much, not only in the same species, but in the same specimen, that I do not think it a character to be relied upon"; and I can support this view in many cases. Often, especially in certain pyrenos, a mature ascus will suddenly begin to elongate and stretch to almost twice its former length, while under examination on the glass slip. This is preparatory to casting its spores; after the elongation has taken place, a slight constriction appears below the middle marked by a dark line, the ascus then breaks in two in a circumscissile manner and liberates its spores. There is nothing of this nature in the Discomycetes so far as my observations go. In *Ascobolus*, the asci elongate a little

when fully mature and carry up the spores above the surface of the disc which then appears studded with the dark, glistening tips of the protuding asci.

The dehiscence of the asci varies a little in the different groups, from the well defined operculum in the genus *Ascophanus*, to the semi-lid, and mere slit in the apex in other groups. Some shoot their spores very freely through a slit in the apex as in *Helotium*; others, as in *Orbilia* cast them very tardily.

It has long been known that the re-action set up in the ascus on the application of iodine varies in the different groups. In some families, the whole of the ascus is affected, in other the apex only, or a point in the centre of the apex. M. Boudier's classification in his recent European Discomycetes is based partly on this phenomena. But these, and a few other interesting points, are outside the purpose of this paper.

In the appended table of measurements, I have omitted those published by Massee in his "Monograph of the Geoglosseae" and other papers, as they are practically the same as mine; in most cases the figures are precisely similar.

The genera and species follow the classification adopted in the Yorkshire Fungus Flora.

Morchella esculenta 300-350 × 16-26μ.
Gyromitra esculenta 450-480 × 14-16μ.
Helvella crispa 290-310 × 17-19μ.
,, *lacunosa* 245-250 × 15μ.
,, *elastica* 310-330 × 17-19μ.
,, *macropus* 340-370 × 15-16μ.
Verpa digitaliformis 290-320 × 19-20μ.
Rhizina inflata 480-520 × 12-16μ.
Acetabula vulgaris 260-290 × 15-17μ.
Geopyxis coccinea 370-400 × 12-13μ.
,, *cupularis* 250-260 × 12-13μ.
,, *albida* 200-220 × 9-10μ.
("Nat." 1900, p. 7).
Peziza reticulata 400-450 × 12-14μ.
,, *sepiatra* 320-360 × 15-16μ.
,, *recedens* 300 × 18μ
("Nat." 1904, p. 4).
,, *ampliata* var. *tectoria*
230-270 × 13-14μ.
,, *subrepanda* 330-350 × 18-20μ.
,, *Adæ* 270-290 × 11-12μ.
("Nat." 1908, p. 218).
,, *badia* 300-340 × 13-14μ.
,, *lividula* 330-350 × 12-14μ.
Peziza succosa 300-340 × 17μ.
Otidea leporina 140-150 × 10μ.
,, *cochleata* 240-280 × 10-11μ.
,, *alutacea* 280 × 12μ.
,, *aurantia* 190-220 × 11μ.
,, *fibrillosa* 270 × 12-13μ.
Curreyella trachycarpa
200-230 × 16-18μ.
Barlaea modesta 250-300 × 23-26μ.
("Nat." 1901, p. 187).
,, *Crouani* 310-330 × 20μ.
,, *cinnabarina* 280 × 21-22μ.
,, *asteroidea* 320-360 × 18μ.
,, *Persoonii* 200-210 × 13-14μ.
("Nat." 1900, p. 9).
Humaria rubens 260-290 × 16μ.
("Nat." 1899, p. 27).
,, *haemastigma* 180-200 × 20μ.
,, *globoso-pulvinata*
140-150 × 16-18μ.
("Nat." 1908, pp. 214-215).
,, *Piggotii* 160-170 × 12-13μ.
,, *convexula* 190-220 × 14-15μ.
,, *carbonigena* 150-170 × 15μ.

Humaria melaloma 190-220 × 10-12μ.
„ *macrocystis* 220-240 × 12μ.
„ *Roumegueri* var. *carnosissima* 200-220 × 13-14μ.
„ *granulata* 180-190 × 13-15μ.
„ *subhirsuta* 250-280 × 14μ.
„ *deerrata* 190-210 × 12-13μ. ("Nat." 1899, p. 31, f. 5).
„ *Phillipsii* 270-290 × 15μ. ("Nat." 1906, p. 9).
„ *violacea* 250-290 × 11μ.
„ *purpurascens* 250-270 × 9μ.
„ *jungermanniæ* 240-280 × 16-20μ.
„ *cervaria* 160-180 × 12-14μ.
„ *fimeti* (= *bovina*) 260-280 × 12-14μ.
„ *Nicholsonii* 65-70 × 8-9μ. ("Nat." 1901, p. 188, f. 19).
Sepultaria semiimmersa 230-270 × 14-16μ.
„ *sumneriana* 290-300 × 18-20μ.
Lachnea contorta 300 × 14-15μ. ("Nat." 1901, p. 182, f. 8).
„ *cinnabarina* 200-220 × 12μ.
„ *crucipila* 210-220 × 17μ.
„ *setosa* 240-260 × 18-20μ.
„ *ascoboloides* 230-240 × 17-18μ.
„ *scutellata* 190-210 × 16μ.
„ *umbrorum* 260 × 20μ.
„ *theleboloides* 220-230 × 12-14μ.
„ *rubra* 215-230 × 15-16μ.
„ *fimbriata* 160-170 × 12μ.
„ *gilva* 200-220 × 12-14μ. ("Nat." 1906, p. 8).
„ *cretea* 240-250 × 10μ.
Neotiella polytrichi (= *P. rutilans*) 290-310 × 18-20μ.
„ *nivea* 280-300 × 20μ-
„ *leucoloma* 200-220 × 16-17μ.
Sphærospora trechispora 320-350 × 18-22μ.
„ *citrina* 300 × 35μ. ("Nat." 1904, p. 4).
Desmazierella acicola 400 × 11μ.
Diplocarpa Curreyana 60 × 6μ. ("Nat." 1901, p. 183).

Dasyscypha virginea 50-60 × 5-6·5μ.
„ *nivea* 45-48 × 4-5μ.
„ *Soppittii* 65-75 × 5-6μ.
„ *inquilina* 35-40 × 5μ.
„ *crucifera* 40-45 × 5μ.
„ *bicolor* 50-55 × 6·5μ.
„ *laetior* 50 × 6·5-7μ. ("Nat." 1904, p. 5).
„ *patula* 55 × 5·5μ.
„ *conformis* 60-65 × 5μ.
„ *leuconica* 50 × 6-6·5μ.
„ *ascuna* 40-45 × 8μ.
„ *acuum* 22-26 × 5μ.
„ *aspidiicola* 30-35 × 5μ.
„ *vitreola* 60 × 7-8μ. ("Nat." 1901, p. 183).
„ *hyalina* 56-65 × 7-8μ.
„ *fugiens* 22-28 × 5-6μ.
„ *calycina* 110-130 × 10-11μ.
„ *subtilissima* 60-70 × 5μ.
„ *canescens* 70-75 × 7·5-8μ.
„ *palearum* 60-63 × 5μ.
„ *fuscescens* 50-55 × 5-5·5μ.
„ *pygmea* 65-70 × 5·5-6μ.
„ *citricolor* 80-90 × 10-12μ. ("Nat." 1901, p. 186).
„ *spiraeaecola* 50-60 × 5μ.
„ *corticalis* 70-80 × 8μ.
„ *Carmichaeli* 40-44 × 7μ.
„ *Richonii* 40-45 × 5-6μ. ("Nat." 1901, p. 186).
„ *dematicola* 80-90 × 4-5μ.
„ *elaphines* 32-35 × 5μ.
Erinella juncicola 60-70 × 8μ.
„ *Nylanderi* 80-95 × 5·5-6μ.
Echinella setulosa 80 × 8-10μ.
Tapesia fusca 60-70 × 7-8μ.
var. *prunicola* 80-100 × 8μ.
„ *cæsia* 30-35 × 5μ.
Sclerotinia tuberosa 190-200 × 9-10μ.
„ *sclerotiorum* 150-160 × 8-9μ.
„ *Candolleana* 100-110 × 6-7μ.
„ *Curreyana* 75-85 × 5·5μ.
Ciboria amentacea 90-100 × 8μ.
Cyathicula coronata 90-110 × 8-9μ.
Helotium badium 110-120 × 11-14μ.
„ *ferrugineum* 90-110 × 9-11μ.
„ *lenticulare* 90-100 × 8-9μ.

Helotium aureum 80-85 × 6-6·5μ.
„ *serotinum* 120-135 × 10μ.
„ *melleum* 135-150 × 12μ.
„ *Hedwigii* 90-100 × 7μ.
„ *lutescens* 90-100 × 8-9μ.
„ *uliginosum* 75-80 × 7μ.
„ *virgultorum* 100-120 × 8-9μ.
„ *aciculare* 90-110 × 12-14μ.
„ *sublenticulare*
120-130 × 9-10μ.
„ *cyathoideum* 50-60 × 5·5-6μ.
„ *scutulum* 90-100 × 8-10μ.
„ *herbarum* 70-80 × 6-8μ.
„ *repandum* 60-70 × 6-7μ.
„ *epiphyllum* 90-110 × 9-10μ.
„ *renisporum* 130-140 × 9-11μ.
„ *fagineum* 80-90 × 9-10μ.
„ *alniellum* 50-60 × 6-7μ.
„ *gramineum* 160-180 × 12μ.
„ *lacteum* 80-100 × 14μ.
Gorgoniceps Guernisaci
270-280 × 6·5-7μ.
Belonium pilosum 78-80 × 8μ.
Belonidium ventosum 150 × 7μ.
„ *Clarkei* 90 × 8μ.
„ *pruinosum* 90-100 × 12-13μ.
„ *lacustre* 80-90 × 12-13μ.
Mollisia fusca 45-50 × 6-7μ.
„ *mercurialis* 40-50 × 7μ.
„ *effugiens* 35-40 × 5-5·5μ.
„ *dilutella* 40-44 × 6-7μ.
„ *nervicola* 40-50 × 5μ.
("Nat." 1901, p. 180).
„ *betulicola* 50-60 × 9-10μ.
("Nat." 1901, p. 181).
„ *juncina* 40-45 × 5-6μ.
„ *stramineum* 40 × 4·5μ.
„ *fallax* 100-120 × 9μ.
„ *pteridina* 35-45 × 5-6μ.
("Nat." 1899, p. 31, f. 19).
„ *hypnorum* 80-90 × 7-8μ.
Pseudopeziza rubi 50 × 6μ.
Ryparobius sexdecimsporus
110-125 × 20-24μ.
„ *Leveilleanus* 120 × 25-28μ.

Ascophanus argenteus 40-50 × 20μ.
„ *ochraceus* 140-150 × 20μ.
„ *carneus* 230-280 × 18-28μ.
var. *cuniculi*
120-190 × 20-30μ.
„ *equinus* 180-220 × 16-18μ.
Ascobolus (Sphæridiobolus)
Crosslandi 170-200 × 25μ.
("Nat." 1899, p. 29, f. 11).
„ *vinosus* 100-120 × 20μ.
„ *glaber* 110-140 × 28-30μ.
„ *Leveillei* 140-160 × 28-30μ.
("Nat." 1899, p. 29).
„ *minutus* 140-160 × 12-13μ.
("Nat." 1900, p. 8).
„ *stictoideus* 150-190 × 40-45μ.
„ *furfuraceus*
180-220 × 22-28μ.
„ *immersus* 280-360 × 80-120μ.
Saccobolus granulispermus
100-110 × 35μ.
("Nat." 1899, p. 30, f. 16).
Orbilia vinosa 50 × 5μ.
„ *auricolor* 40-45 × 5-6μ.
„ *leucostigma* 40-45 × 4-5μ.
Agyrium rufum 75-80 × 10-11μ.,
Coryne sarcoides 140-150 × 10-12μ.
„ *aquatica* 57-60 × 6μ.
("Nat." 1904, p. 6).
Bulgaria polymorpha 170-190 × 8-9μ.
Cenangium furfuraceum
100-120 × 6-7μ.
„ *pulveraceum* 55-65 × 5-6μ.
„ *dryinum* 125-130 × 16-17μ.
„ *sarothamni* 50-55 × 6-7μ.
("Nat." 1901, p. 179).
Scleroderris rubi 80-85 × 18-20μ.
„ *livida* 96-100 × 16-18μ.
Patellea pallida 80 × 10-12μ.
Karschia lignyota 38-44 × 10-12μ.
Durella melanochlora 60-90 × 8-12μ.
("Nat." 1904, p. 6).
Nemacyclus niveus 90-100 × 10-12μ.
Trochila craterium 65-70 × 9μ.

CLAVARIA CONCHYLIATA.

By W. B. Allen.

Clavaria conchyliata Allen, Pl. 8.

Minuta, tenuissima; gregaria sed basi discreta; clavulis primo simplicibus apice dentatis, dein dichotomo-ramulosis, e violaceis decolorantibus, 5-10mm. longis; stipite pubescente rufo-carneo; carne alba; mycelio filamentoso albo; sporis hyalinis globosis $2{\cdot}5$-3μ.

In coryletis ad terram nudam, Tickwood Salop, Oct., 1908.

This is a minute but very beautiful *Clavaria*, quite easily recognised by the brilliant violet colour of the branches, which are irregular and divaricate with somewhat digitate ends, whilst the trunk is reddish-yellow (nankeen) and pubescent. It is gregarious but scattered in habit, each stem separate at the base and not at all fasciculate.

NOTES ON MARINE PYRENOMYCETES.

By A. D. Cotton, F.L.S.

The fungi which are found growing in the sea are few in number. Those that are so found are small if not microscopic species, and they occur for the most part in the tissues of the Marine Algae or Seaweeds. Of the total number of marine fungi that have been described, about fifteen species belong to the *Chytridiaceae*, nine to the *Pyrenomycetes*, and some six others to various groups of the *Phycomycetes* or Lower Fungi.*

With regard to the *Chytridiaceae* in more than one instance, the real nature of the body described as a fungus is open to question. The life-history of this group of fungi is often exceedingly difficult to follow out, and it is therefore not surprising that our knowledge of the marine species is still very incomplete. There is no doubt, however, that species of *Chytridiaceae* do occur in Marine Algae, indeed in some of the smaller species of *Ectocarpus* and allied genera they may be noticed very frequently. Their minute size, and the difficulty of obtaining certain important stages in their life-history render

* The fungi forming the fungal constituent of Lichens are not included in the present paper.

it no easy matter to assign them to their correct systematic position. With the *Pyrenomycetes* on the other hand, the case is altogether different. There is no difficulty here in recognising the organism as a fungus, and if ripe perithecia can be obtained, the genus can also be readily determined.

The following notes concern only *Pyrenomycetes*. They deal with (1) *Leptosphaeria Chondri*, Rosenv., a species not previously recorded as British, and (2) *Mycosphaerella Ascophylli* sp. nov., a species noted so long ago as 1893, though hitherto unnamed. At the conclusion a brief review is given of other marine *Pyrenomycetes*.

LEPTOSPHAERIA CHONDRI (Rostr.) Rosenv.

Leptosphaeria Chondri occurs in the fertile portions of the frond of the well-known alga *Chondrus crispus* (Carrigeen Moss). It was first described by Rostrup in 1889 as *L. marina*. His plants were found at Klitmoller in Denmark, and his description, though somewhat brief, clearly sets forth the main features of the fungus. In 1906, Rosenvinge found specimens of the plant at several localities on the north Danish coast, and in a note on the subject he gives a detailed description, and also points out that the name given by Rostrup (*L. marina*) was already in use for a different plant; he therefore changed the name to *L. Chondri*. This same fungus also appears to have been found in North America, having been dealt with under the name of *Sphaerella Chondri*. The material was obtained from the Massachussetts coast, and was described by Jones in 1898. *Sphaerella* (=*Mycosphaerella*, Johans,) and *Leptosphaeria* are very closely allied genera, and differ mainly in the arrangement of the asci and in the absence of paraphyses in the first-named genus. The writer has not seen any of the American material, but from the description, there is no doubt that Jones' plant is the same as that of Rostrup and Rosenvinge. The above appear to be the only records of *Leptosphaeria Chondri*.

The British specimens were found on fronds of *Chondrus crispus* at Swanage, Dorset, in February, 1908. None of the infected *Chondrus* plants obtained were attached to the rocks, but were washed up on the shore. Many of the fronds, however, were in a comparatively fresh condition, and had, doubtless, only recently become detached. In other specimens, which had evidently been floating for a longer period, the black patches, indicating the presence of the fungus, were very conspicuous owing to the host-plant being more or less bleached. Rosenvinge, in addition to finding it on *Chondrus* plants washed ashore, found it also on growing plants, including those which were completely submerged even at low tide. There is not the

slightest doubt, therefore, that the fungus is truly marine.

The mycelium of *Leptosphaeria* appears to be fairly localised, being confined to those portions of the algal frond that bear cystocarps or nemathecia. It is intercellular and not very abundant. The perithecia are found both in the cystocarpic cavities and in the tetrasporic sori. Owing to the mycelium in the immediate neighbourhood of the fruiting bodies being dark, and these latter being formed close together, the area infected by the fungus forms conspicuous black spots 1-2mm. in diameter. In addition to the ascigerous perithecia, numerous pycnidia are also produced. The presence of these bodies is known in other species of *Leptosphaeria*, and it is of interest to find them so well developed in a marine form.

The manner of the infection of the *Chondrus* by the fungus has not been ascertained. From the localisation of the mycelium it would appear that the germinating ascospore gains entrance in the neighbourhood of the young cystocarps and nemathecia, and that at a very early stage; so that entry through the openings caused by the discharge of carpospores and tetraspores is improbable. The mycelium produced destroys the adjoining tissues and also some of the spores, and finally forms, in close proximity to the spot where infection originally occurred, a number of fruits.

Asci are very difficult to observe as they deliquesce at an early stage. The spores vary considerably in size, but this may be largely accounted for by difference in age. Neither Rostrup, Rosenvinge, nor the writer succeeded in finding any that could be considered fully ripe. Rosenvinge suggests the possibility of the spores not ripening until after the death of the *Chondrus* fronds. If this be the case, there would be an analogy with those terrestrial *Leptosphaerias* in which the ascigerous stage does not mature until the death of the host-plant.

The following is a revised description of *L. Chondri*:—

LEPTOSPHAERIA CHONDRI, Rosenvinge, Meddelte derefter, p. xxxiii. (1906); *Leptosphaeria marina*, Rostrup, Mykol., Meddel., p. 234 (1889); *Sphaerella marina*, Jones, a new species of Pyrenomycete (1898).

Mycelium localized; fruits (perithecia and pycnidia) collected together into groups forming black spots. Perithecia 10-15 together, black, immersed, subglobose $125\text{-}215 \times 110\text{-}300\mu$ broad: ostiole not protruding. Asci clavate, 8-spored $70\text{-}80 \times 10\text{-}15\mu$ (?); spores fusiform, hyaline unequally 2-celled, $25\text{-}40 \times 5\text{-}7\mu$ (immature); paraphyses branched, very slender. Pycnidia 12-20 together, black, immersed, subglobose, $150\text{-}175 \times 85\text{-}100\mu$; pycnospores hyaline $4 \times 1\mu$.

HAB.—In cystocarps and nemathecia of *Chondrus crispus*, Stackh.

FRUITING SEASON—July, Sept. (Rosenvinge), Feb. (Cotton).

DISTRIBUTION—Denmark (Klitmoller, Hanstholm, Hirshals, Skagens); Britain (Swanage); North America (Massachusetts.)

MYCOSPHAERELLA ASCOPHYLLI, sp. nov. (See pl. 4.)

The fungus about to be described was first noted by Church, who, in the Annals of Botany for 1893, drew attention to the presence of a minute Pyrenomycete in the "pods" of *Ascophyllum*. Neither name nor diagnosis was given, and since that date the fungus has apparently not received any further attention.

Ascophyllum nodosum, the alga which this fungus infests, is one of the common wracks, and is widely distributed on the coasts of Britain, and may be found in fruiting condition from December till June. The perithecia of *Mycosphaerella Ascophylli* are only produced in the receptacles or "pods" of the *Ascophyllum*, and the latter, if examined during the season named (or at all events from January onwards) are found to be almost invariably infected with the fungus. No blackening of the tissue takes place as in the case of *L. chondri*, but the perithecia are produced singly and are just visible to the naked eye as minute black spots.

On sectioning the *Ascophyllum* receptacles, a large quantity of very slender mycelium is to be found traversing the tissue in all directions, and this can also be traced into the main fronds of the alga. The mycelial filaments seldom measure more than 1·5-2μ thick. The perithecia are completely immersed in the host-tissue, with a scarcely protruding ostiole. They are small (100-130 x 80-90μ) and contain but very few asci, it is possible, however, that a succession of these bodies may be formed (see Pl. 4, upper figure). Nearly ripe spores may be found in most of the perithecia from February to May, but it would appear that the spores are ejected almost as soon as they become ripe, as spores that are fully mature can seldom be found. No pycnidia such as are produced in *Leptosphaeria* have been observed.

The mycelium as stated above is very abundant, but in spite of this fact the host-plant remains quite uninjured. The presence of the mycelium in other parts of the host as well as in the receptacles is of great interest, and suggests that the endophyte is perennial. Quite young plants have been found to contain mycelium, and it seems probable that infection takes place at a very early stage. The writer hoped to have been able to follow out the life-history of the fungus, especially with regard to infection, but owing to pressure of other work this

was impossible. The ascospores of the fungus and the oospores of the seaweed being liberated at the same time, suggests the possibility of the ascospores being caught in the mucilaginous substance of the latter, and infection taking place during the early stages of the segmentation of the egg.

The description of *M. Ascophylli* is as follows:—

* *Mycosphaerella Ascophylli* sp. nov. Mycelium diffused; fruits formed in the receptacles of the host-plant. Perithecia very minute, flask-shaped, black, scattered, immersed, 100-130 × 80-90μ; ostiole small, not prominent. Asci few, oblong, often curved, apex thickened, 8-spored, 50-60 × 18-20μ; paraphyses absent. Spores fusiform, biseriate, hyaline, 1-septate, not constricted, 18-21 × 4-5μ.

HAB.—In living receptacles of *Ascophyllum nodosum*.

FRUITING SEASON—Jan.-May

GEOG. DISTRIB.—Britain (many localities, North Sea, English Channel, Irish Sea); Faeroe Islands; Heligoland. Sweden (West Coast).

The following is a brief summary of what is known as to other marine *Pyrenomycetes*.

GUIGNARDIA PRASIOLAE (Winter) Reed, in Two new Ascomycetous Fungi, p. 151 (1902); *Laestadia Prasiolae* (Winter), Exotische Pilze, iv., p. 16; Hariot, in Miss. Sci. du Cap Horn, p. 188, tab. 2. See also *Ulva tessellata* Hook and Harv. Algae Antarcticae, p. 297, (1845); *Mastodia tessellata* Harv. and Hook. Flora Antarctica, ii., p. 499, tab. 144, fig. 2 (1847).

The history of *Guignardia Prasiolae* is interesting, and may be worth referring to here, as this was the first marine fungus to attract attention. When first described, the minute perithecia, which are scattered all over the leafy frond of the green alga *Prasiola*, were regarded as the fruits of the alga, and it was not until many years later that their true nature was discovered.

The original gatherings of the *Prasiola* were obtained by Sir Joseph Hooker in Kerguelen's land, and were described by him in conjunction with Harvey as *Ulva tessellata* in 1845. Two years later in Flora Antarctica the same authors formed, for the reception of the plant, a new genus—*Mastodia*. This genus was regarded as being allied to *Ulva*, but differing from

* *Mycosphaerella Ascophylli* sp. nov. Perithecia minutissima, globoso-piriforma, nigra, sparsa, in matrice omnino immersa, 100-130 × 80-90μ; poro minuto, haud prominulo. Asci pauci, curvuli, octospori, 50-60 × 18-20μ. Sporae fusiformes, biseriatae, hyalinae, medio-1-septatae, haud constrictae, 18-21 × 4-5μ.

Hab. In receptaculis vivis *Ascophylli nodosi*.

it in the possession of capsular fruits. For the next thirty years, systematic algologists placed the plant in various positions, but not having examined the specimens themselves, they all completely misunderstood it. Bornet was the first to observe the dual nature of the organism, and in 1887, Hariot, another Paris algologist, published a paper in which he showed that the alga was a species of *Prasiola* (*P. tessellata*, Hariot), and that the capsular fruits were the perithecia of a fungus. The latter he stated had been named by Winter *Physalospora Prasiolae.*

Prasiola is a genus which grows both in salt and fresh water. Hooker's specimens were obtained from fresh-water streams in Kerguelen's land (Flora Antarctica, p. 499), but Hariot also obtained from Tierra del Fuego, material which grew on marine rocks. The technical description of the fungus was not dealt with by Hariot, but handed over to Winter, who placed it in the genus *Laestadia* instead of *Physalospora*, naming it *L. Prasiolae* sp. nov. Hooker's original specimens are preserved in the Kew Herbarium, and these quite confirm Hariot's observations. In 1902, Miss Reed transferred the fungus to *Guignardia*, as the name *Laestadia* was pre-occupied by a genus of *Compositae.* The asci of *G. Prasiolae* measure $53\text{-}57 \times 9\mu$, and the spores are hyaline, aseptate, and measure $12\text{-}15 \times 3{\cdot}5\text{-}4\text{-}5\mu$.

GEOG. DISTRIB. Kerguelen's Land, Tierra del Fuego.

In connection with the above, attention may be drawn to Reinsch's genus *Dermatomeris* (Süsswasseralgenflora, p. 359, tab. iv., fig. 12-14; Meeresalgenflora, p. 425, tab. xix., fig. 1 a-e), which was founded on material brought from South Georgia by the German South Polar Expedition of 1882-3. The plant was described as a marine lichen allied to *Mastodia.* The figures show perithecia embedded in a *Prasiola*-like frond, and the organism is doubtless of a compound nature composed probably of a *Prasiola* and a Pyrenomycete allied to, if not identical with, *Guignardia Prasiolae*, Reed.

GUIGNARDIA ALASKANA, Reed. Two new Ascomycetous Fungi, p. 151, pl. 15, fig. 7, pl. 16, fig. 8-14 (1902).

The present plant occurs on *Prasiola borealis*, Reed, in the northern region of Alaska. This is a fact of interest when it is remembered that a fungus of the same genus occurs on *Prasiola tessellata* in the subantarctic Kerguelen's Land. It is possible that the two plants may be but one species, though from the published accounts there is a difference in the size of the asci and spores. The Alaskan *Prasiola* is so completely infected by the fungus and the perithecia are so abundantly produced, that the organism almost suggests a lichen, indeed the authoress employs the term "composite" throughout her paper. The asci measure $25\text{-}33 \times 7\text{-}4\mu$, and the spores are hyaline, aseptate, $10\text{-}13 \times 3{\cdot}5\text{-}7\mu$.

GEOG. DISTRIB. North America (Unalaska, Kadiak Islands).

GUIGNARDIA ULVAE, Reed. Two new Ascomycetous Fungi, p. 142, pl. 15, figs. 1-6 (1902).

Small specimens of *Ulva* are commonly found infected with this fungus in the neighbourhood of San Fransisco, California. The fungus completely infests the host-plant as in *G. Alaskana*, but the amount of distortion produced is not so great. The authoress again refers to the organism as a "composite"; spores hyaline, aseptate, 10-13 × 3·5-7μ.

GEOG. DISTRIB. North America (San Fransisco Bay).

AMPHISPHAERIA POSIDONIAE, Ces et De Not., Schema Sf., p. 224 (1863); *Sphaeria Posidoniae* Dur. et Montagne. Flora Alg., p. 502 (1846!), t. 25, fig. 8 (1846!); Montagne Syll., p. 229, No. 804.

Amphisphaeria Posidoniae recorded by Montagne sixty years ago occurs on *Posidonia oceania*, Del, a marine Phanerogamic plant allied to *Zostera.*

Regarding this fungus, the original describers say: "De toutes les espèces qu'un de nous (Durieu) a rapportées de l'Algérie, celle-ci est, sans contredit, la plus curieuse sous le rapport biologique, puisqu'elle passe sa vie et parcourt au fond de la mer toutes les périodes de sa morphose." (Fl. Alg., p. 503)

GEOG. DISTRIB. *France* (Marseilles, Toulon). *Algeria* (La Galle, Mostagonem, Algiers).

EPICYMATIA BALANI, Winter MSS. in Hariot, note sur le genre *Mastodia*, p. 233.

Epicymatia is allied to *Pharcidia*, a genus containing a number of species which are parasitic on lichens, and some writers regard it as not differing essentially. *E. Balani* was observed by Bornet on *Brachytrichia Balani*, a marine alga allied to *Nostoc*. Spores hyaline, 1-septate, 19-23 × 6-7μ.

GEOG. DISTRIB. France (St. Malo).

DOTHIDIELLA LAMINARIAE Rostrup, Tillaeg til Grönl Swampe 1891; Mykol. Medd. v., p. 212 (1895).

This species is peculiar in being the only marine member of the *Dothidiaceae*. Spores hyaline, 1-septate, 20-21 × 7-8μ.

GEOG. DISTRIB. Greenland (West Coast).

PHARCIDIA MARINA, Ch. Bommer, Un champignon pyrenomycète (1891).

It is quite possible that this plant may be connected with *Epicymatia Balani.* Neither plant has been recorded more than once. *P. marina* occurred on the barnacle *Balanus balanoides* and *E. Balani* occurred on the Blue-green alga *Brachytrichia* which infests barnacles. *Balanus balanoides* is a barnacle of fair size, occurring on rocks between tide-marks, and not uncommon on the British Coasts. Spores of *P. marina* hyaline, 1-septate, 12-18 × 4-7μ.

GEOG. DISTRIB. Holland.

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EXPLANATION OF FIGURES.

Pl. iv., *Mycosphaerella Ascophylli*, asci and spores × 400, and spores × 600.

RECENT WORK ON THE REPRODUCTION OF ASCOMYCETES.

By H. C. I. Fraser, D.Sc. (Lond) F.L.S.

The method of reproduction among Ascomycetes has been perhaps one of the most disputed of mycological problems, and is certainly one the unravelling of which has gone through a curious series of vicissitudes.

Bulliard, in 1791, in his history of the "Champignons de France," put forward the suggestion that the ascus was a female organ fertilized by some substance emanating from the paraphyses.

Systematic study of the question was initiated by De Bary and his pupils in the middle of the last century; they investigated a considerable number of species and recognised that, before spore formation took place, a special filament appeared, fused with another, branched, and at the ends of its branches gave rise to asci. De Bary inferred that the branching filament was female, the filament with which it conjugated male, and the asci the product of an act of normal fertilization. Subsequently he pointed out that, in certain forms, one or both filaments were absent and that in these cases asci must be developed either from an unfertilized female cell or in the complete absence of sexual organs.

De Bary's interpretation of his discoveries was not universally accepted. Brefeld denied the sexual nature of the filaments observed, Van Tieghem regarded them in certain cases as organs of respiration, and other botanists as boring organs.

In the meantime considerable advances were being made in the detailed study of sexuality both among animals and plants. It became recognised that an essential part of fertilization was the association of male and female *nuclei*, and that cell fusion was a mere preliminary to this. It was discovered also that every nucleus possesses a constant and definite number of nuclear elements or *chromosomes*, and it followed that when two nuclei unite this number must be doubled. It followed again that before a subsequent fertilization, initiating the next generation, could take place, the original, or half number must be restored, and the point in the life history at which this reduction of the chromosome number to half occurs was recognised for several forms.

While the attention of biologists was thus becoming focussed on the nucleus, Dangeard (6), in 1894, announced that he had observed a fusion of closely related nuclei in the ascus of

Peziza vesiculosa and some other forms. He accepted this process as an act of fertilization, defined the ascus as an egg and called upon the upholders of the sexuality of the Ascomycetes to recognise with him that fertilization occurred, and upon its opponents to deny with him that it took place at the stage indicated by De Bary.

The importance of Dangeard's observation was still scarcely realized when Harper (19) in 1895 confirmed it in *Sphaerotheca humuli*. He further studied the development of this species and recorded not only nuclear fusion in the ascus, but the presence and union of the filaments described by De Bary. He saw the entrance of the nucleus of the male filament into the other and its fusion with the female nucleus. Moreover, he made out that it was from this fertilized filament that the ascus arose, and that the nuclei which fused in the ascus were the descendants of nuclei produced by the foregoing act of fertilization. Thus it was clear that in Ascomycetes occurred the unprecedented case of two nuclear fusions succeeding one another in the same life history.

Dangeard (7), with little delay, himself undertook the study of *Sphaerotheca humuli* but did not observe Harper's first fusion; it is perhaps only necessary to add that its occurrence has since been confirmed by other workers (1) for this species and by Harper himself for the related forms *Erysiphe communis* (20) and *Phyllactinia corylea* (22). There seems thus no doubt that the two fusions, even if absent in Dangeard's material, are of common occurrence among *Erysiphaceae.*

In 1900, the two fusions were seen by Harper in the Discomycete *Pyronema confluens* (21), but here the filaments, which we may now follow De Bary in calling sexual organs, contain each not one but several nuclei and fertilization thus consists of the union not of one but of several separate pairs.

Later, in 1905, a similar case was described in detail by Claussen (3) for *Boudiera Claussenii* (= *Ascodesmis nigricans?*) and evidence which makes the occurence of normal fertilization very probable had, in the meantime, been brought forward for several other species.

The next step was the investigation of the forms described by De Bary or his pupils as possessing a female organ only, and in 1906 an account of the life history of *Humaria granulata* was published (2). Here the female cell, like that of *Pyronema confluens* possesses several nuclei, but the male organ has entirely disappeared and the fusion of male with female nuclei is replaced by the union of the female nuclei in pairs. In this, as in other forms, a subsequent fusion takes place in the ascus.

In 1907 a corresponding discovery was made for *Ascobolus furfuraceus* (25), and I was so fortunate as to be able to

describe yet another case in *Lachnea stercorea* (13); here, however, the male filament, is still present though, in my specimens it did not function and normal fertilization is again replaced by the fusion of female nuclei in pairs.

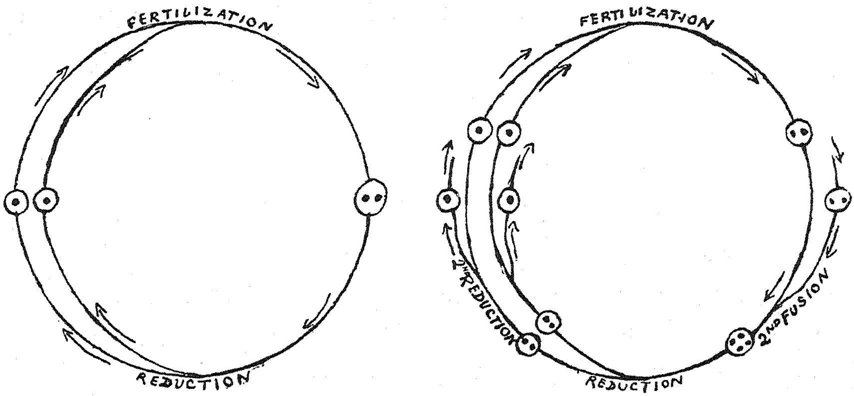
At about the same time Dangeard (8) published a most interesting memoir, in which he described the development of the sexual organs in a number of species, and showed that a passage of male nuclei into the female cell did not take place in his material. Unfortunately he did not deal with the possibility of the union of female nuclei in pairs but assumed that, as the male filament was not functional, nuclear fusion could not take place at this stage.

Towards the end of 1907 Claussen carried out a further study of *Pyronema confluens* (4). He saw the male nuclei pass, in accordance with Harper's description, into the female organ, but he asserted that they did not fuse with the female nuclei but only became associated with them in pairs; the associated nuclei travelled two and two up the ascogenous hyphae and finally fused in the ascus. In other words the ascus fusion was the final union of pairs of sexual nuclei which had become associated some time before in the female organ, and only one fusion took place in the life history of Ascomycetes.

Claussen's paper was followed by an account of the life history of *Humaria rutilans* (14). This fungus may be very conveniently studied, as the nuclei are exceptionally large and clear. I found, with regard to the sexual organs, a stage of reduction more advanced than that in *Humaria granulata*, since not only the male, but also the female filament has disappeared and fertilization is replaced by the fusion in pairs of vegetative nuclei, the nuclei of the ordinary hyphae. Subsequently the descendants of these nuclei were seen to undergo a second fusion in the ascus.

So far this fungus only adds another to the cases in which two fusions have been recorded, but, owing to the size of the nuclei it was further possible to study, in some detail, their behaviour in the ascus. It had already been pointed out by various authors (Gjurasin (17), Maire (23), Guillermond (18), Harper (22), etc.) that the fusion nucleus in the ascus divides three times, and that the first two of these divisions correspond to the two peculiar divisions which, in other organisms, have been shown to bring about that reduction of the number of chromosomes to half, which is the necessary corollary of their doubling in fertilization. In *Humaria rutilans* it was possible to see very clearly that this was the case, and it was further found that, after the number of chromosomes has been thus reduced to half in the course of the first two divisions, the remaining number is again halved during the third. So that, in the course

of the life history of this fungus, the number of nuclear elements is twice doubled by the two successive fusions, and then twice halved during the divisions in the ascus. This state of affairs may be compared diagrammatically with that which occurs in an ordinary plant or animal.



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Humaria rutilans does not stand alone in these peculiarities, for it has since been shown that similar processes take place in *Peziza vesiculosa* and *Otidea aurantia* (16); and certain earlier investigations by Harper (22), Maire (23) and others appear open to a corresponding interpretation.

To sum up, there are two main views with regard to this aspect of the sexuality of the Ascomycetes. One, foreshadowed in 1791 by Bulliard, and supported, among others by Dangeard and by Claussen, locates the sexual fusion in the ascus and denies the occurrence of any other nuclear union; the other, initiated by De Bary and his pupils and extended by Harper and by a number of workers in this country accepts the existence of two fusions, recognises the first, that in the "female" organ, as sexual, and regards the second as peculiar to Ascomycetes and as compensated by the equally peculiar second reduction.

Probably most investigators would now agree in regarding De Bary's filaments as phylogenetically male and female organs whether they had convinced themselves that some form of fertilization still takes place in the latter or whether they held that it had shifted to the ascus. It would seem evident moreover that normal sexuality is at present disappearing among Ascomycetes and that even the same species will, under varying conditions, show various degrees in the structure and efficiency of its sexual cells.

In this connection, an interesting degeneration series may be traced: in *Pyronema confluens*—to take the more fully investigated Discomycetes only—and in *Boudiera*, the formation of functional male and female filaments takes place and normal fertilization occurs; in *Lachnea stercorea* the female organ is still normal, but the male, though present is functionless and the female nuclei fuse in pairs; in *Humaria granulata* the male filament is absent, and in *Humaria rutilans* the female organ also has disappeared and sexual fusion is reduced to a mere union of vegetative nuclei; finally it may be suggested that in some forms fertilization will have altogether ceased. Perhaps such cases are among those studied by Dangeard and his allies, but, if this be so a corresponding absence of the easily recognisable stages of the halving of the chromosome number is to be expected, and will afford convincing proof of the non-occurrence of its doubling in fertilization.

In another direction the study of reproduction among Ascomycetes seems likely to do something towards an understanding of the relationships of at any rate the great groups. In *Aspergillus* (or *Eurotium*) *herbariorum* it has recently been pointed out (15) that the female organ consists of three parts, a multicellular stalk, a single fertile cell or *ascogonium*, and a single terminal cell or *trichogyne* through which the male nuclei must pass to reach those of the ascogonium. The fertile cell alone gives rise to ascogenous hyphae, but, before doing so, it divides into several multinucleate portions. In *Pyronema confluens* the female branch is similarly constructed, but the stalk is less conspicuous and the ascogonium, instead of being long and narrow, is spherical and gives rise to ascogenous hyphae without becoming septate.

In *Lachnea stercorea* the state of affairs is similar, but oddly enough the trichogyne, when mature, consists not of one but of several cells, and that although the now functionless male filament is developed close at hand. Possibly it is the difficulty connected with the breaking down of so many cell walls that has put an end to normal fertilization in this species.

The female branch of *Humaria granulata*, though now without a trichogyne, also conforms to this type, and that of *Ascobolus furfuraceus* can probably be derived from it. Similar structures have been seen in other Pezizaceae, which still await full investigation, and it may perhaps be suggested that the *Pyronema* type is characteristic of Discomycetes generally. In *Boudiera*, however, the structure approximates much more closely to that of *Aspergillus*, and the comparatively narrow female cell becomes septate after fertilization.

The male filament, in *Aspergillus*, has a multicellular stalk like that of the female, and terminates in a small cell, the

antheridium proper, which contains several nuclei. In *Boudiera*, in *Pyronema*, and in such other of the investigated Discomycetes as still show a male organ, the antheridium is much larger and develops as a stout oblong body seated on a short stalk.

Among Pyrenomycetes a quite different type of female organ occurs; in *Gnomonia erythrostoma* (10, 12), in the investigated species of *Polystigma* (11), in *Poronia punctata* (9), and in various Lichens, it forms a long, coiled structure divided into numerous cells. Beyond the coil is a straight portion terminating externally in a swollen cell and constituting the trichogyne; some of the cells at the other extremity of the coil form a stalk; but, since fusion of the sexual nuclei has not yet been observed in these cases, it is impossible to say whether the true ascogonium is multicellular before, or only, as in *Aspergillus*, after fertilization.

In this group the presumptive male organ is again a filament terminating in a small cell, but such filaments are very numerous and are aggregated in flask-shaped spermagonia and the terminal cell is cut off as a *spermatium* and carried by the wind to the trichogyne It thus seems that the spermatium may be readily homologised with the antheridium of *Aspergillus*, and consequently with that of the Discomycetes. This comparison is the more suggestive since it has recently been shown (26, 27) that among the Red Algae undoubted antheridia are detached from their parent plant, and are carried to the female organ in a corresponding way.

There thus appear to be two main types of male and female organ: that characteristic especially of Discomycetes where both antheridium and ascogonium are more or less spherical, where the former does not become detached and the latter (probably for some reason connected with its shape) does not become septate after fertilization; and, secondly, that characteristic of a number of Pyrenomycetes in which the female organ is elongated and richly septate and the antheridium is minute and becomes detached and carried by external agencies to the trichogyne. An intermediate, and not improbably primative stage seems to occur in *Aspergillus herbariorum*, and has been indicated in other forms.

These main types do not of course include all the very numerous variations of reproductive structure described among Ascomycetes. In the Erysiphaceae, for instance the female organ is without a trichogyne and the antheridium fuses directly with the fertile cell. A similar arrangement is found in the genus *Gymnoascus* (5), and it may be suggested that the latter, with its slightly developed perithecial wall forms part of a degeneration series terminating perhaps in *Eremascus* (24), where the asci are borne free on the branches of a simple mycelium.

It is, however, probably still too early to speculate on the relationships which may be indicated by the structure of the sexual organs, and their disappearance has been shown to occur in groups so diverse as to make it without importance in classification.

An enormous number of forms still demand investigation, and a further knowledge of their structure and cytology cannot fail to solve some, at any rate, of the problems of this group, and through them, not impossibly, of a wider field.

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THE BLEEDING-STEM DISEASE OF THE COCOANUT TREE IN CEYLON.

With two Photographs, Pl. 9. *By T. Petch, B.A., B.Sc.*

The Bleeding-stem Disease of the Cocoanut Tree has recently been the cause of much anxiety to the planter* in Ceylon. It appears to be a disease which has existed for many years, but during the last two it has extended with great rapidity, so much so as to alarm the cocoanut growers. The accompanying illustrations show the disease as it affects young trees, B, and older ones, A. In the former it extends with greater rapidity, quickly reaching the "cabbage," as the growing apex of the palm is called, and causing the destruction of the tree. It attacks the stem, causing the exudation of a brownish liquid from the small cracks which occur on every cocoanut stem. It forms a rusty wet patch on the bark, which is at first reddish, then dirty brown, and eventually black. On cutting into the stem through a patch the internal tissues are found to be decayed, at first dirty brown, then black in colour. Usually the part immediately behind the crack from which the liquid is issuing is black and is surrounded by a wetter brown zone, in which the rot is advancing. The diseased tissue is originally only of small extent and well defined. These spots may occur at any height on the stem: about six or eight feet is the most usual position, but occasionally trees are attacked at the base. The diseased areas coalesce, and as they extend the whole stem in the last stages becomes merely a hollow cylinder filled with a brown mass resembling garden soil. Of course when the disease reaches the crown or "cabbage" of the tree it dies. If an old tree is attacked the fungus does not cause so great a flow of liquid as it does with a young one, nor does the fungus penetrate the hard woody tissue of the stem so deeply as is the case with a young one. Fig. A shows an old stem that has been attacked—a large hollow wound has been formed in the outer tissues. Fig. B shows the effect of the fungus on a younger tree in which the extension of the disease has already reached the cabbage and caused its destruction. The fungus *Thielaviopsis ethacetica* Went. was isolated from the diseased tissue and spores from pure cultures used for infecting healthy trees, so that the cause of the disease was placed beyond doubt. The same fungus occurs in the West Indies and

*About a million acres in Ceylon are under cultivation for Cocoanut trees. Ninety trees are grown per acre. In one province alone 440,000 trees were examined officially and found to contain 80,000 affected ones.

in Mauritius. On sugar cane it causes the "pine apple disease" of the sugar-cane of Java—which is so-called because of the odour of the decaying cane. In Ceylon the odour is not noticeable in the cocoanut stems, but it is particularly well developed when the fungus was growing luxuriantly on the culture dishes in the laboratory at Peradeniya. The preventive measures recommended were cutting out the diseased tissues, scorching the interior of the wound with a torch made of rags dipped in paraffin oil or with the flame of a painter's blow pipe and painting with hot coal tar.

Thielaviopsis is one of the black moulds Dematieae allied to those fungi which used to be placed in the old genus Torula. It has conidia of two kinds, the larger are produced in chains ovate, dark brown, $16\text{-}19 \times 10\text{-}12\mu$, the smaller cylindrical hyaline $10\text{-}15 \times 3{\cdot}5\text{-}5\mu$ produced concatenately from the interior of hyphæ.

FUNGUS NOTES FOR 1908.

By M. C. Cooke.

WITH PLATE 5.

The following is the record of a few species of British Fungi which have been submitted to me during the past year. The two varieties appear to me novel and of interest, and worthy of record.

Clitocybe obscurata Cooke, Pl. 5, fig. C.

Pileus plane, then infundibuliform, moist greyish umber, smooth. Stem slightly attenuated downwards, same colour as pileus, solid, smooth, or but slightly striate. Gills decurrent, rather distant, white. Spores subelliptical, $3\text{-}4\mu$ long.

Amongst grass, Edmond Castle, Carlisle, September, 1908 (Miss Decima Graham).

Odour mealy. Pileus 2in. diam., stem 1-2in. long. Closely allied to *Clito. clavipes* but manifestly distinct, pileus never obconic but soon infundibuliform; stem rather attenuated downwards, and comparatively shorter than in *C. clavipes*.

Clitocybe connata Schum. Sacc. Syll. 588, Pl. 5, f. A.

White. Pileus fleshy, thin, conical then expanded, unequal, naked, moist, obtuse umbo evanescent. Stems hollow, broad, smooth, connate at the base. Gills unequally decurrent, narrow,

crowded subarcuate. *Bres. Fung. Trident.*, t. xxxiii., Lucand t. 355.

On the ground, in moist woods, September, 1908, Edmond Castle, Carlisle (Miss Decima Graham).

Pileus broad but thin, not viscid, 8-10cm. broad; stems 8-13 cm. long, 1-2cm. thick; spores $8 \times 3\text{-}4\mu$.

Collybia dryophila Bull. var. *alvearis* Cooke, Pl. 5, f. B.

A rather large and coarse variety of a very variable species.

Pileus dome-shaped, resembling the old straw beehive, obtuse, larger than in the type, 3 inches if expanded, even, smooth, rufescent at the disc. Stem thick, nearly 1cm. at base, a little attenuated upwards, very hollow, rufescent. Gills and spores as in type.

Amongst dead leaves, September, 1908, Edmond Castle, near Carlisle (Miss Decima Graham).

Inocybe Godeyi Gillet, var. *rufescens* Cke.

This variety was found by Miss Decima Graham at Edmond Castle, Carlisle, October, 1908, about a dozen specimens in all.

It is wholly white at first, and then with reddish blotches at the margin of the pileus, and on the stem. Dimensions of cap and stem, as well as the spores, same as in the type.

One correspondent states that a specimen placed on white paper to dry communicated a pink stain to the paper.

Helvella guepinioides Berk. and Cooke. Mycographia p. 198, fig. 337. Pl. 5, fig. D.

Specimens collected by Miss Decima Graham at Edmond Castle, Carlisle, October, 1908, are the first which have been discovered since the originals were found in North Wales. The pileus is quite pale creamy ochre, not dark as in the figure, which was drawn from dried specimen, and the stem is quite white, and not sulcate, as in *H. crispa.* Sporidia rather larger than in the dried specimen $20\text{-}22 \times 12\text{-}13\mu$, or according to another measurement $21\text{-}23 \times 13\text{-}14\mu$, and, when fresh, with a large central nucleus. Paraphyses broadly clavate and uncoloured. Specimens deposited in the Kew Herbarium.

NEW OR RARE MICROFUNGI.

By A. Lorrain Smith, F.L.S.

WITH PLATE 6.

PHYCOMYCETES.

PHYSODERMA Wallr. Fl. Germ. II., p. 192 (1833).

Mycelium parasitic within the cells of living plants; Sporangia not known; resting spores intracellular, at length lying free in the host cell, globose or ellipsoid, with a thick brown epispore, contents colourless with many oil-drops.

Physoderma Heleocharidis Schroet. Kryptogamen Fl. Schlesien III., p. 194 (1889).

Forming elongate, rather flat swellings on the stalks of the host. Resting spores one or several in the host-cell, globose or elliptical, 18-28μ long, 13-18μ wide, with a smooth brown epispore about $1\frac{1}{2}\mu$ thick.

On stems of *Scirpus palustris.* Collected by Mr. D. A. Boyd at Stevenston, Ayrshire, August, 1907.

Peronospora Chrysosplenii Fuck. Fungi Rhenani n. 1509 (1865).

Tufts loose, delicate, white; conidiophores 5-8-forked, solitary, slightly bulbous at the base, 200-360μ high, the branches upright, those towards the tip usually unequal, straight or bent, mostly at right angles; conidia ovate, 20-22$\mu \times$ 15-18μ; oospores globose, smooth, with a clear-brown thickish epispore, 28-48μ in diameter, which, according to Schröter in Krypt. Flora Schlesien III., p. 247 (1889) is often marked with a fine net-work.

On leaves of Saxifragaceae. Found by Mr. D. A. Boyd on leaves of *Chrysosplenium alternifolium* near Dalry, Ayrshire, May 4th, 1908.

A fine specimen with both conidiophores and oospores. Mr. Boyd adds that the common *C. oppositifolium* did not seem to be affected by the parasite.

Empusa conglomerata Thaxt. in Mem. Bost. Soc. Nat. Hist. IV., n. 6, p. 162, t. 15, figs. 56-62 (1888).

Fertile hyphae simple; primary conidia broadly ovate, mostly uniguttulate, 25-40$\mu \times$ 22-25μ; secondary conidia similar to the primary; spores produced from a spherical mass of hyphae, supported on a slender process of varying length.

On flies (*Melanostoma scalare*), Lyndhurst, New Forest.

This species of *Empusa* had already been identified by G. Massee. I am not aware, however, of its having been recorded. The flies, which had been killed by the fungus, were entangled together and attached to the flower head of *Rumex acetosa*.

Protomyces pachydermus Thüm. in Hedwigia XIII., p. 97 (1874).

This fungus has been already recorded several times for our country, although on the whole rather rare. Specimens were sent to me in July by Mr. Swanton, Haslemere, that had been collected at St. Leonard's-on-Sea by Mr. E. Connold, F.Z.S. The elongate swellings on the petioles and midribs varied in size, one at least measured $1\frac{1}{2}$ cm. in length. Spore measurements are from 25-45μ in diameter, the usual size being about 35μ. These correspond with the spores from one of Thümen's specimens. The measurements published by Plowright (Brit. Ured., p. 300) and by Massee (Brit. Fungi. Phyc. and Ustil., p. 163) are too small.

DISCOMYCETES.

Humaria globosa-pulvinata Crossl. Naturalist 1898, p. 214.

An unusual form somewhat resembling an *Ascophanus*.

On sediment in disused dye tank, Hebden Bridge.

Sclerotinia baccarum Rehm.

The sclerotia of this discomycete, which are produced in fruits of the bilberry (*Vaccinium Myrtillus*) were first noticed in this country by Prof. Trail. The apothecia were discovered by Mr. D. A. Boyd, in May, 1908, on the Campsie Hills, Stirlingshire, on withered bilberry fruits.

Journ. Bot. XLVI., p. 299 (1908).

Dasyscypha campylotrichia A. L. Sm., Pl. 6, f. 3.

Ascomata minute, about 150 to 200μ in diameter, scattered or somewhat gregarious, closed at first, and when dry bright lemon-yellow coloured, open when moist and disclosing a slightly darker disc, the exterior and more especially the edge beset with hairs, subulate at the base, tapering towards the curved tip, from 30μ to 45μ long, about 4μ in width at the base; asci clavate, shortly stalked, about $35\mu \times 8\mu$; spores small, ellipsoid, colourless, $5\mu \times 2\mu$.

On stems of thistle. Collected by Mr. Menzies at Scone, Perthshire, October, 1908.

Erinella pommeranica Ruhl. Verhandl. Bot. Ver. Prov. Brandenburg XLI. (1900), p. 82, fig. c.

Ascophores scattered or gregarious, $\frac{1}{2}$-2 mm. wide, externally

white-hairy, at first globose, the disc concave, bright-golden or orange-yellow; asci cylindrical, sessile, 80-100$\mu \times$ 8-10μ, slightly attenuate and round at the tips; spores filiform, colourless, multiseptate and guttulate, 75-90$\mu \times 2\mu$; paraphyses filiform, simple, slightly thickened at the tips.

On the bark of *Pinus silvestris*. Found by W. H. Wilkinson, at Rothesay, Isle of Bute, August, 1908. Recorded previously from Pommerania.

The asci of the Scotch specimen are slightly longer, measuring up to 120μ. They are sessile or produced below into a very short, rather bent stalk. Mr. Wilkinson likens the growing plant to a bird's nest of white coral lined with gold.

Helotium Marchantiae Fr. var. *conocephali* Boyd.

Apothecia variable in size, pale at first, becoming dark-brown, usually occurring on pallid patches of the host thallus; spores oblong, fusiform, rather large, 18-21$\mu \times 5\mu$; paraphyses slightly brownish in the mass.

On the thallus of *Conocephalus conicus*, especially in winter and spring, Dalry, Ayrshire.

Distinguished from the species by the larger spores, and by occurring on blanched spots on the host.

Orbilia marina (Phil.) Boyd, in Brit. Assoc. Handbook on the Nat. Hist. of the Clyde Area (1901), p. 69. Calloria marina Phil. MS., and Pl. 6, f. 1, a, b, c, d.

"Scattered, erumpent, sessile, at first concave, then plane or convex, thin, transparent when moist, circular, varying from alutaceous to pale orange; asci cylindraceo-clavate; sporidia 8, elliptic-oblong, 8-10 $\times 4\mu$; paraphyses slender, apices clavate.

"Cups scattered widely over the Fucus, 250μ in diameter.

"On decaying fronds of *Fucus*, &c.

"Should stand next after Calloria Leightoni."—Phil. in litt.

"The above was descriptive of specimens gathered by me at West Kilbride, Ayrshire, about twenty years ago, and submitted by me to Mr. Phillips.

"*O. marina* is apparently widely distributed over the West of Scotland, and has occurred on the sea-shore at West Kilbride, Largs, Ardrossan, and Stevenston (Ayrshire); Invercloy (Island of Arran); Etterick Bay (Bute); and Ardkinglas, Loch Fyne (Argyllshire). It is found on fronds of *Fucus*, *Ascophyllum*, *Halidrys*, &c., which have been washed ashore during storms, and lie decaying on the sands beyond the ordinary tide-mark at high-water. It has been observed in autumn and spring, but may probably occur throughout the year, wherever decaying seaweed is abundant."—D.A.B.

Ephelina Prunellae Phill. MS. Pl. 6, f. 2, a, b, c, d, e, f.

Apothecia developed on the hyphae of *Asteroma Prunellae* in small groups, on a common stroma, about ½ mm. in diameter, dark brown in colour; asci elongate clavate $75\text{-}80\mu \times 8\text{-}10\mu$; spores oblong, slightly bent or straight, colourless, simple, $15\mu \times 5\mu$; paraphyses forked near the base, slender, widening at the tips to $3\text{-}4\mu$ in width.

On living leaves of *Prunella vulgaris* developed on *Asteroma Prunellae*. Corriegills, Island of Arran, April, 1908, Mr. D. A. Boyd.

"About twenty years ago, during a period of mild and rainy weather in spring, I gathered specimens of *Asteroma prunellae* Purt., which appeared to be abnormally developed so as to bear cups of the type of a Discomycete. These were submitted to Mr. William Phillips, F.L.S., who stated that he regarded them as belonging to a species of *Ephelina* hitherto undescribed, and which he proposed to name *E. prunellae*. He also sent for inspection some drawings of the cups, asci, and spores, which were afterwards returned to him. No description of *E prunellae* is believed to have appeared during Mr. Phillips's lifetime. The species is, however, referred to as occurring at Largs and West Kilbride in Brit. Assoc. Handbook on the Nat. Hist. of the Clyde Area, p. 69.

"During the present spring, when searching for microfungi in Renfrewshire and Ayrshire, I have observed many specimens of *A. prunellae* showing abnormal development, but with imperfectly formed cups. At Corriegills, near Brodick, Arran, on 20th inst., I was so fortunate as to find *E. prunellae* with its cups fully expanded."—D. A. B., 30 April, 1908.

Tapesia retincola Karst. in Act. Soc. Faun. and Fl. Fenn II., n. 6, p. 137 (1885).

Apothecia congregate, sessile, on a thick blackish felt of brown, septate hyphae, at first globose, closed opening and becoming cup-shaped, then somewhat plane, the disc whitish or yellowish, exterior brown, rough; asci cylindrical-clavate, $100\text{-}110 \times 5\text{-}6\mu$, 8-spored; spores almost cylindrical, blunt, straight or somewhat bent, one-celled with 2-4 guttulae, becoming 2- (4-?) celled, colourless, $15\text{-}18\mu \times 2\text{-}2{\cdot}5\mu$; paraphyses, slender, yellowish.

On dead stems of *Phragmites*, Hornsea Mere, Yorkshire; Mr. C. Crossland, Naturalist, 1908, p. 309.

Stictis fimbriata Schwein. Syn. Fung. Amer. Bor., p. 986 (1831).

Apothecia congregate, immersed, raising the cortex, globose, the edge hairy, snow-white, rather waxy and soft, small, less

than 1 mm. in diameter, almost closed when dry to a white point; asci cylindrical, sessile, bluntly pointed at the apex, 70-90$\mu \times$ 8-9μ, 8-spored; spores filiform, rounded at the ends, vermicular, with numerous guttulae, then up to 5-septate, 50-60$\mu \times$ 2·5-3μ; paraphyses filiform, loose, colourless.

On *Pine cones*, Beaufort Woods, Inverness-shire, September, 1908.

The spores measure slightly longer than the size given above, being up to 75μ in length. The specimen agrees otherwise with the description.

PYRENOMYCETES.

Erysiphe galeopsidis DC. Flore Franc. VI., p. 108 (1815).

Mycelium on both sides of the leaf, widely spread or in circumscribed spots, later disappearing; haustoria with lobed appendages; perithecia small; asci ovate-ellipsoid, shortly stalked, containing usually 2 or 3, rarely up to 15 spores; spores not developed till the following spring.

On leaves of *Labiatae*, Mr. J. F. Rayner, Isle of Wight, October, 1907.

Podosphaera myrtillina Kunze Mykol. Hefte II., p. 111 (1823).

Mycelium scarcely visible. Perithecia chiefly on the underside of the leaf, scattered or crowded, depressed-globose, small; appendages 4-10 inserted on the upper half of the perithecium diverging or curved; ascus globose, 8-spored, 70-80μ in diameter; spores ellipsoid, colourless, 25-30$\mu \times$ 15-17μ.

On *Vaccinium Myrtillus* and *V. uliginosum.* Found by Mr. D. A. Boyd on *V. Myrtillus*, Beaufort Castle Woods, Inverness-shire, September, 1908.

Rhopographus pteridis Wint. and see Pl. 6, f. 4, a, b, c.

A specimen of this fungus was collected at Brapperton, Yorks., by T. Gibbs, jun., which deviates from the published diagnosis in the size and septation of the spores, as recorded by Saccardo, and later by Winter, these are 3-, at most 5-, septate, about 30$\mu \times$ 7 or 8μ, and possess hyaline appendages. In the specimen from Brapperton no hyaline appendages were found either by Mr. Gibbs or myself, and many of the spores were 6 or 7 septate and 37$\mu \times$ 10μ. In other respects it is typical *Rhopographus pteridis*, though it might rank as *f. macrosporus.*

Sordaria fimicola Ces. and de Not. Comm. Crit. Ital., p. 226 (1861).

Var. *canina* Boyd in litt. *Hypocopra fimicola* var. *canina* Karst. Mycol. Fenn. 2, p. 50 (1873).

Differs from the species in the larger spores, measuring $18-26\mu \times 14-16\mu$.

Found by Mr. D. A. Boyd on dog's dung, Beaufort Castle Woods, September, 1908.

MÜLLERELLA Hepp ex Müller in Principes de Classif. d. Lichens in Mém. Soc. Phys. Hist. Nat. Genève 2 ème partie, p. 80, reprint.

Perithecia more or less immersed, globose, black, opening by a pore; asci polyspored; spores 1-celled, brown; paraphyses indistinct.

M. polyspora Hepp lc., p. 80, f. 23.

Perithecia minute, globose, at first almost immersed, later projecting, scattered or in groups of 2 or 3; asci oblong or cylindrical-obovate with delicate walls, $50-60\mu$ long, containing 150 spores; paraphyses disappearing; spores oblong-elliptical, minute, pale smoky-brown, $5-7\mu \times 2\frac{1}{2}\mu$.

On the thallus of *Biatora luteola.*

Found on a specimen of *Opegrapha atra* from the Larbalestier Herbarium in the British Museum collected at Trinity, Jersey, and marked *Opegrapha cinerea* Chev.

Leptosphaeria circinans Sacc. Syll. Fung. II., p. 88 (1883).

On base of stem of *Lucerne* from Wye College.

G. Massee gives an account of this fungus in Journ. Bot. XLVI., p. 151 (1908). He quotes Continental Mycologists who consider this to be the fruiting stage of *Rhizoctonia violacea*, and he also refers to the statement by Professor Rolfs, that the fruiting form is *Corticium vagum* var. *Solani* (= *Hypochnus solani*). He calls attention to the fact that *C. vagum* is a saprophyte on the bark of dead conifers, while the var. *Solani* is a parasite on the roots of plants.

Pleospora equiseti A. L. Sm., Pl. 6, f. 5, a, b, c.

Perithecia minute blackish-brown, almost globose, growing beneath the epidermis, not emerging, opening by a pore, from $200-270\mu$ in diameter; asci clavate, very shortly stalked, $90 \times 12\mu$; spores brownish-yellow, 5-septate, the median cells with longitudinal septa, $25-27\mu \times 6-8\mu$.

Forming minute black spots on dead stalks of *Equisetum*, Kilwinning, Ayrshire, Mr. D. A. Boyd, January, 1908.

Gnomonia riparia Niessl. in Oesterr Bot. Zeitschr., 1875, p. 47.

Perithecia growing in small groups, developed under the outer bark, then becoming free, globose at first, then collapsing, with a cylindrical beak, which is sometimes bent and paler at the tip.

Asci clavate-fusiform, almost sessile, 4-spored, 32-45$\mu \times 6\mu$. Spores in two rows, fusiform, bent or unequal-sided, obtuse, with a delicate hair-like appendage, 3-septate, 4-guttulate, faintly constricted in the middle, 14-16$\mu \times 3\mu$.

On dead stalks of *Epilobium hirsutum.*

On dead rose-twigs, Dalry, N.B., Mr. Scott Elliot.

The difference of habitat casts some doubt on the identity of the fungus, but the absence of paraphyses, the size and form of apothecia, and spores are the same as in the form on *Epilobium.* The spores (usually 4 only in the ascus) are mostly 4-guttulate with a distinct median septum, the other septa are less obvious. The hair-like appendage is only occasionally to be seen.

Diaporthe detrusa Fuck. Symb., p. 205 (1869).

Stromata usually numerous, often developed in lines, broadly cone-shaped, projecting, usually covered by the cortex, black, yellowish-brown within, up to 2 mm. wide, the blunt ostioles piercing the bark. Perithecia fairly numerous, crowded, angular-roundish, the base usually sunk in the wood, the ostioles short, only shortly surpassing the stroma; asci cylindrical, slightly clavate, rounded at the apex, sessile, 65-75$\mu \times$ 10-11μ; spores in two rows, oblong, rounded at both ends, slightly narrower towards the base, 1-septate, 13-16$\mu \times 5\mu$, or somewhat thicker.

On dead branches of *Berberis vulgaris.* Collected by Mr. D. A. Boyd, Dalmellington, Ayrshire, August, 1908.

Anixia truncigena Hoffm. Icon., p. 70, t. 17, f. 2 (1863).

Perithecia globose, brown, smooth, bursting irregularly and exposing the sulphur-yellow contents; asci cylindrical with long stalks, 8-spored, the spore-bearing parts 76$\mu \times 12\mu$; spores globose, simple, 9-10μ in diameter.

On roe dung, September, 1908.

Cooke's two British species of *Orbicula* (*A. perichaenoides* and *A. cyclospora*) agree with the above description except that neither of them are given as yellow internally, a very striking feature of the fungus.

Found by Mr. James Menzies, Perth, in a dense thicket of Fir-trees.

SPHAEROPSIDEAE.

Phyllosticta Forsythiae Sacc. Fung. Ital., n. 87 (1877) and in Mich. I., p. 93.

Spots suborbicular, becoming ochraceous, scarcely margined. Perithecia on the upper surface of the leaf, rarely on both sides, often concentrically arranged, at first innate and yellowish, 150-180μ in diameter, opening by a pore; spores ovoid or cylindrical ovoid with 2 guttulae, 5-7$\mu \times 3\mu$.

On leaves of *Forsythia suspensa*, Seamill, Ayrshire. Collected by Mr. D. A. Boyd, August, 1907.

Phyllosticta mahoniana Sacc. Mich. II., p. 90 (1880).

Perithecia on dried spots of the leaves, depressed, globose, minute, about 150μ in diameter; spores elongate, 8-10$\mu \times 2\mu$, colourless, sporophores rod-shaped, 10-12μ long.

On Mahonia Aquifolia, Mr. D. A. Boyd, Balmacaan, Inverness-shire, September, 1908.

The circumscribed spots and minute perithecia are characteristic of this species; some of the spores have a faint trace of septation in the middle, which would seem almost to indicate an *Ascochyta*.

Ascochyta Philadelphi Sacc. and Speg. in Mich. I., p. 165 (1877).

Spots almost circular, becoming ochraceous. Perithecia punctiform, 150-200μ in diameter, sometimes concentrically arranged, opening by a pore; spores 2-celled, slightly constricted, round at the ends, colourless, 8-11$\mu \times$ 4-4·5μ.

On leaves of *Philadelphus coronarius*, Seamill, Ayrshire. Collected by Mr. D. A. Boyd, August, 1907.

Ascochyta Quercus-Ilicis, Güssow in Journ. Bot. XLVI., p. 123, t. 489, figs. 1-4 (1908).

"Perithecia scattered, somewhat conical, punctiform, blackish olive green, growing on the lower surface of the leaves, covered by stellate hairs. 110-130μ diam. Sporules lanceolate, 1-septate, somewhat constricted at septum, hyaline to light-green. 12-14$\mu \times$ 3-4μ."

On the under surface of leaves of *Quercus Ilicis*. No locality. Pl. 489 E, figs. 1-3.

The author evidently means that the perithecia are developed under the stellate hairs of the leaf.

Septoria menthicola Sacc. and Letendre, Syll. III., p. 539 (1884).

Spots small, almost round, on both sides of the leaf, almost ochraceous; perithecia punctiform, lenticular, perforate at the apex; spores filiform, bent, continuous, 30μ-40$\mu \times 1\mu$, colourless.

On decaying leaves of *Mentha arvensis*. Found by Mr. D. A. Boyd at West Kilbride, Ayrshire, August, 1908.

Coniothyrium tumaefaciens Güss. Journ. Hort. Soc. XXIV., p. 230 (1908), figs. 35 and 36.

Pycnidia scattered, free, conical or globular, with round, apical opening, blackish-brown, from 300μ-345μ in diameter;

conidiophores long, septate, unbranched or slightly branched at top, 29-38μ long; conidia unicellular, pale dirty green, short or long ovoid, 5-7$\mu \times$ 3-4μ.

Causing large warty excrescences from the size of a pea to that of a walnut, on shoots of blackberry, Kent, England.

Gloeosporium Salicis West. Herb. Crypt. Belg. No. 1269; Sacc. Syll. III., p. 711 (1884).

Seated on black, confluent spots on the upper surface of the leaves; spores elongate, slightly curved, simple, 2-guttulate.

On living leaves of *Salix*. Beith, Ayrshire, Mr. D. A. Boyd, September, 1907.

No spore measurements are given in the original diagnosis. Briosi and Cavara have published drawings and measurements in No. 125 of their set "*I Funghi parassiti delle planti coltivate od utile*," and they give the size of the spores as 14-16$\mu \times$ 8μ, which does not quite correspond with the figure, being too wide for the length. My own measurements are 12-16$\mu \times$ 4-6μ.

Fuckel (Sybol. Myc. p. 277) recognizes it as the pycnidial form of *Trochila salicis* Tul., which has not yet been detected in Britain.

Colletotrichum malvarum Southw.

Recorded last year from Alyth, Perthshire, has appeared this year in the South of England, and has been found by Mr. Chittenden on plants of *Lavatera trimestris* from Langley, Bucks, and Alton, Herts.

Marssonia Daphnes Sacc. Mich. II., p. 541 (1882).

Pustules on both sides of the leaf, small, congregate on greenish or brownish irregular spots. Spores ovate, somewhat bent, narrowed at the ends, 1-septate towards the base, colourless, granular, very shortly stalked, 20$\mu \times$ 4-6μ.

On living leaves of *Daphne Mezereum*. Collected by Mr. D. A. Boyd at Traquair, Peeblesshire, October, 1908.

SEPTOGLOEUM Sacc. in Michelia II., p. 11 (1880).

Spore pustules parasitic on leaves, small; spores elongate with 2 or more septa, colourless. Similar to *Gloeosporium* but with septate spores.

S. salicinum Sacc. Syll. III., p. 802, and see Pl. 6, f. 6, a.

Pustules irregularly scattered over the upper surface of the leaf, white, seated on a brown spot of irregular form; spores elongate, subfusiform, bent or curved, 40-45μ long, with three indistinct septa, each cell guttulate.

On living and decaying leaves of *Salix*. Found by Mr. D. A. Boyd on leaves of *S. viminalis*.

The spores of the British specimen measure somewhat less than the size recorded, 35μ or under, $7\text{-}10\mu$ in width. One septum is always clear, the others indistinct or often absent.

HYPHOMYCETES.

Monilia humicola Oudem. in Arch. Neerland. Sci. ex. Nat. Ser. 2, VII., p. 286, t. 20 (1902).

Tufts thick, round. Sterile hyphae creeping at first, hyaline becoming greenish with age, conidiophores upright, yellow or greenish, septate, branched, the branches numerous, alternate or almost opposite, once or twice dichotomous, divided into cylindrical, easily separable cells; conidia in chains, at first globose, then elliptical, pointed at each end, greenish, $4\text{-}10\mu$ long, $2\text{-}5\mu$ thick.

On soil.

Var. *brunnea* A. L. Sm.

Differs from the species in habitat and in colour; it is a bright brown.

On decaying Birch wood, Divach Wood, Drumnadrochit, Inverness, September, 1900.

SCOPULARIOPSIS Bain. in Bull. Soc. Mycol. France XXIII., p. 98 (1907).

Tufts brightly coloured, white, greyish, yellowish or reddish; conidiophores short, irregular, branched like *Penicillium*, the branches covered by a delicate membrane; conidial branches relatively very long; conidia rather large, round or oval, smooth or echinulate, associated with some conidia pointed above or truncate below. Saprophytes on decaying substances.

S. communis Bain. l.c. p. 127, t. 16, figs. 3-6.

On decaying herbaceous stems, Ealing (G. Massee), in Journ. Bot. XLVI., p. 154, Pl. 489, fig. a (1908).

Ovularia Bistortae Sacc. Syll. Fung. IV., p. 148 (1886).

Tufts loose, thin, white, on dry spots of the leaf, hyphae fasciculate, subsimple, flexuous; conidia oblong, ovate, simple, colourless, $12\mu \times 6\mu$.

On leaves of *Polygonum Bistortae*. Collected by Mr. D. A. Boyd at Kilmarnock, Ayrshire, August, 1897, and at Bardowie, Stirlingshire, August, 1908.

CALCARISPORIUM Preuss. in Linnaea XXIV., p. 124 (1851).

Hyphae forming a felt, septate and branched. Conidiophores upright, septate, verticillate, the terminal branches swollen at

the tips and warted; conidia single on each wart, colourless, simple.

C. arbuscula Preuss. l.c., and see Pl. 6, f. 7, a, b.

Tufts white, spreading, conidiophores with few branches, the ultimate branches awl-shaped, verticillate; spores elongate, rather small, with a small beak at the base.

On decaying fungi. Rev. W. L. W. Eyre, Swarraton, Hants, June, 1908.

No measurements nor drawings are given with the original diagnosis of this monotypic genus, but Prof. Lindau, to whom I have submitted it, agrees with me that it is *Calcarisporium* and probably *C. arbuscula.* The conidiophores are from $\frac{1}{2}$ to 1 mm. high, about 4μ in width, the verticillate branches are short, $15\mu \times 3$-4μ, the spores elliptical-oblong 5-$7\mu \times 3\mu$, with sometimes a minute beak at the place of insertion.

Ramularia violae Trail in Scott. Nat. IV., p. 74 (1889).

Spots on both sides of the leaf, subcircular, confluent, sometimes occupying the whole leaf; conidiophores erect, subclavate, 1-septate, 20-$25\mu \times 3$-4μ; conidia in chains of 2 to 3, fusiform or sub-cylindrical, round at the ends, straight, colourless, becoming 1-septate, 10-$16\mu \times 2$-3μ.

On living leaves of *Viola sylvatica.*

Found by Mr. D. A. Boyd at Stevenston, Ayrshire, August, 1907.

R. ajugae (Niessl.) Sacc. F. Ital. f. 1009, and Syll. IV., p. 212 (1886).

Spots subcircular, ochraceous or whitish. Hyphae in short tufts, unbranched, continuous, denticulate above, hyaline, 20-$25\mu \times 3$-4μ, conidia cylindrical, fusiform, 1-septate or continuous 15-$20\mu \times 4\mu$, often apiculate at both ends, at first shortly catenulate.

On leaves of *Ajuga reptans*, Glen Falloch, Perthshire, July, 1907, Mr. D. A. Boyd, and Glen Urquhart, Inverness-shire, September, 1908.

TILACHLIDIUM Preuss. in Linnaea XXIV., p. 125 (1851).

Forming an erect stroma of compact hyphae, simple or branched; conidiophores basidia-like rising from the upright stroma, and bearing at the tips a head of conidia budded off singly, but remaining united by mucilage and forming a globose head.

Similar in habit to *Isaria* but differing in spore formation.

T. subulatum A. L. Sm. Pl. 6, f. 8, a, b, c.

Stromata gregarious, yellowish or greyish white, upright, bearing on all sides, awl-shaped, simple or branched, ½-1 or 2 mm. high; conidiophores 25-35 mm. long; conidia forming a small globose head 5-6μ in diameter, individual conidia cylindrical, about 5-7$\mu \times 2\mu$.

On plant debris, Drumnadrochit, Inverness-shire, and Swarraton, Alresford, Hants (Rev. W. L. W. Eyre).

The species approaches *T. pinnatum*, but differs in the form and size of the spores; the absence of measurements in that species, however, renders determination somewhat doubtful.

BASIDIOMYCETES.

Entyloma achilleae P. Magnus in Abh. Naturhist. Gesell. Nürnberg XIII., p. 8 (1900).

Forming pustules on and round the leaves, becoming brownish; resting spores formed in the tissue of the host, almost globose, colourless, 12·6μ long, 10·3μ wide.

Parasitic on *Achillea millefolia*. I. of Bute, Mr. D. A. Boyd, August, 1907.

The resting spores in the specimen from Bute measure on the whole less than those described by Magnus, being usually 10-11μ in diameter. The species is very near *E. matricariae*, but the spores are smaller and with a less developed epispore.

Uromyces caryophyllinus Schröet. Brandpilze, p. 10 (1872) fide Sacc. Syll. VII., p. 545.

Sori minute, round or oblong, uredosori scattered, becoming uncovered; teleutosori forming elongate confluent lines on the stem, at first covered by the epidermis; uredospores spherical, elliptical or oblong, 40$\mu \times$ 17-28μ, covered with minute points, pallid brown; teleutospores globose, irregularly round or ovoid, rarely oblong, mostly thickened and broadly pallid at the apex, 23-35$\mu \times$ 15-22μ, smooth, brown, pedicel 4-10μ long, soon falling away.

On leaves of *Dianthus*. Collected by Mr. D. A. Boyd on Carnations at Finlaystone, Ayrshire, August, 1907.

The description and dimensions given by Fischer (Beitr. Kryptogamenflora der Schweiz, p. 11 (1904)) correspond exactly with Mr .Boyd's specimen, the uredospores measuring up to 35μ in length and 21-26μ wide, the membrane clear brown, thick and covered with fine points. The teleutospores are not present in the specimen.

Aecidium phillyreae DC. Flor. Fr. V. (VI.), p. 96 (1815).

On leaves and young shoots of *Phillyrea latifolia.* Collected by L. Pevensay in Sussex. (G. Massee Journ. Bot. XLVI., p. 153 (1908)).

Puccinia Cardui-pycnocephali Sydow Mon. Ured. I., p. 34, t. 3, fig. 35 (1902).

On living leaves and stems of *Carduus pycnocephalus.* Collected at Sidmouth and also between Eastbourne and Hastings by G. Massee. Journ. Bot. XLVI., p. 152 (1908).

P. Pazschkei Dietel in Hedwigia XXX., p. 103 (1891).

On living leaves of *Saxifraga longifolia,* Kew Gardens, G. Massee, l.c.

P. obtegens Tul. in Ann. Sci. Nat. Ser. 4 II., p. 87 (1854).

G. Massee points out (l.c.) that this name must replace *P. suaevolens* Rostr. The rust grows on *Cnicus arvensis.*

DESCRIPTION OF FIGURES, PL. 6.

1. *Orbilia marina* Boyd. a, Fungus slightly enlarged on *Ascophyllum nodosum;* b, asci and spores × 550; c, paraphyses × 500; d, spores × 500.
2. *Ephelina Prunellae* Phill. a, Leaf of *Prunella vulgaris* with fungus on upper surface; b, slightly enlarged; c, section through group of Ascomata enlarged × 40; d, asci × 500; e, paraphysis × 500; f, spores × 500. (a and b by W. Phillips from drawing in herbarium of Brit. Mus.)
3. *Dasyscypha campylotrichia* sp. nov., a; plant enlarged 60 times; b, hairs from margin; c, ascus × 550; d, spores × 550.
4. *Rhopographus Pteridis* Wint. a, Stalk of bracken with fungus; b, ascus × about 500; c, spores × about 500. (Drawings by T. Gibbs.)
5. *Pleospora equiseti* n. sp. a, Perithecia under epidermis slightly enlarged; b, ascus × 500; c, spores × 500.
6. *Septogloeum salicinum* Sacc. a, Spores × 500.
7. *Calcarisporium arbuscula* Preuss. a, Conidiophores × 500; b, spores × 800.
8. *Tilachlidium subulatum* n. sp. a, Stroma × 120; b, Conidiophores with globose head of spores × 500; c, spores × 500.

SUPPLEMENTARY LIST COMMUNICATED BY MR. H. C. HAWLEY.

Coprinus tigrinellus, Boud. c.f. Naturalist, 1908, p. 320.

Nolanea minuta Karst.

On bare ground beneath *Iris Pseudacorus* and *Lycopus Europaeus*. Recorded by T. Gibbs for Yorkshire in Naturalist 1908, p. 410. I showed my specimens to Gibbs but he did not examine them critically. I have little doubt my plant was this species.

Galactinia ionella Quél.

On bare, rather heavy ground in wood. Tumby, Lincolnshire, 8, 1908. Teste Mons. E. Boudier.

Coronellaria amoena Boud.

On dead stems of rush and grass. Tumby, Lincolnshire, 8, 1908. Teste Mons. E. Boudier. I believe only previously recorded from Montmorency.

Trichophaea leucotheciodes Rehm.

On charred wood. Oban, 9, 1908. I sent this to M. Boudier, suggesting *cretea*, Phill., but he considers it to differ in spores as well as habitat.

Trochila lauro-cerasi Desm. var. *smaragdina* Lév.

On dead leaves of cherry-laurel, Tumby, 11, 1908. Teste Mons. E. Boudier.

NEW AND RARE BRITISH FUNGI.

By Carleton Rea, B.C.L., M.A., &c.

WITH PLATES 7 AND 8.

Lepiota irrorata Quél. As. Fr. 1882, t. 11, f. 2, Fl. Myc. p. 294 and see pl. 8.

Pileus 2·5-5 cm. wide, convex, yellowish then straw coloured, *covered with dew-like or tear-like transparent drops* which are also apparent on the stem. Stem 3-4 cm. long, 7-10 mm. thick, stuffed then hollow, silky, *variegated with small yellow or brown squamules*, white and satiny above the narrow ring.

Flesh white. Gills emarginate, 4 mm. wide, free, ventricose, white then cream colour. Spores ovoid, 4-5 × 4μ, punctate.

On the ground under a large tree, Benthall Edge, Shropshire, 29th June, 1908, Mr. W. B. Allen.

Easily distinguished from its allies by the dew-like drops that cover the surface of the pileus and stem and by the coloured squamules on the latter.

Tricholoma luteocitrinum Rea, Pl. 8.

Pileus 2-7 cm. latus, carnosus, e campanulato, expanso-gibbosus, centro luteus, margine involuto citrino, *floccosus, mox squamulis minutis obtectus, dein in maturo in fibrillas revolutas secedens.* Stipes 6-7 cm. longus, 1-2 cm. crassus, solidus, albidus, flavo-maculatus. Caro albida, sub cute pilei citrina et ad basim stipitis lutea, odore nullo, sapore miti. Lamellae 4-5 mm. latae ex albidis stramineae, sinuato-adnatae, subconfertae. Sporae albae, ellipticae 6 × 4μ, hyalinae, 1-guttulatae, leves.

In sylva laricina Dunballoch, Inverness, 15th September, 1908. Legit A. Cowan.

Distinguished from *Tricholoma acerbum* (Bull.) Fr. by the floccose pileus soon breaking up into adpressed squamules which finally become revolute and fibrillose and the absence of any bitter taste.

Mycena virens (Bull.) Quél. Bull. t. 560, f. 2, P.R., chloranthus, Fr. Obs II., t. 5, f. 2. Fl. Dan., t. 1614, f. 2, and see Pl. 7 hereof.

Pileus conico-campanulate then expanded, 10-15 mm. wide, membranaceous, striate, *olive green* soon becoming paler disc yellow. Stem 7-10 cm. long, 2-3 mm. thick, hollow, glabrous, *bluish*, transparent, villose and white at the base. Gills adnate, narrow, 2 mm. wide, white with a slight tinge of green, thin, crowded. Spores elliptical or plum-shaped, 8-9 × 5-6μ, white in the mass as deposited on a spore map, slightly greenish by transmitted light.

In a hedgerow near Swarraton Rectory, 31st October, 1907. Miss J. Eyre.

This beautiful *Mycena* is easily recognized by its pleasing green striate pileus and bluish stem.

Nolanea minuta Karst.

Collected by T. Gibbs on bank of peaty ditch in Arncliffe Wood, Yorkshire. Naturalist, 1908, p. 320.

Crepidotus versutus Peck.

Pileus resupinate then reflexed, sessile, thin, white, covered

with a soft villose tomentum, margin incurved. Gills rather broad, somewhat distant, concurrent in an excentric point, rounded behind, pallid then ferruginous. Spores subelliptical, ferruginous brown, 9-10 × 4-5μ, smooth.

On dead wood, Mr. H. C. Hawley, Tumby, Boston, Lincolnshire, 20th November, 1908.

This species was kindly determined by our member Monsieur René Maire. In general appearance it resembles *Claudopus variabilis* (Pers.) W. G. Sm., but is distinguished by the larger size and darker colour of the spores.

Coprinus bulbillosus Pat., Tab. Anal. Fung. p. 60, f. 658. Massee, A revision of the genus Coprinus, Annals of Bot. vol. X., p. 145. European Agaricaceae, p. 230, and see Pl. 7 hereof.

Pileus convex then expanded, 5-10 mm. across, grey with the disc yellow, *covered with white meal* at first, striate at the margin and incurved. Stem 10-20 mm. long, 1 mm. thick, white, *base bulbous*, ring loose, median. Gills 1 mm. wide, grey becoming black. Spores irregularly round, 8-9 × 8μ, black.

On horse dung, Swarraton, 29th July, 1908, Rev. W. L. W. Eyre, and Brahan Castle Woods, Strathpeffer, Ross-shire, 23rd September, 1908, Mrs. Carleton Rea.

Distinguished from *C. Hendersonii* by its spores and the bulbous base of the stem.

Coprinus platypus Berk. & Cke. Cooke's Handbook of British Fungi, 2nd ed., p. 234.

Mr. James Menzies reports that he has found this plant on the dead stems of *Phalaris arundinacea* in the neighbourhood of Perth. It was previously only recorded as growing on *Palm* stems in conservatories in England.

Coprinus Patouillardii Quél. As. Fr. 1884, Fl. Myc. p. 46, Pat. Tab. Anal. Fung., p. 107, fig. 240. Massee, A revision of the genus Coprinus, Annals of Bot., vol. X., p. 172. European Agaricaceae, p. 238, and see Pl. 8 hereof.

Pileus conico-campanulate then expanded 5-20 mm. across, plicato-sulcate up to the disc at maturity, ashy-grey, disc *yellowish and rough with minute reddish granules.* Stem 1-4 cm. long, 2 mm. thick, white, glabrous, fragile. Gills free, attached to a collar, 2 mm. wide, distant, at first cream colour then becoming black. Spores angularly globose × 6-7μ, black with a hyaline apiculus.

On old spent tea leaves turned out in a bucket at 34, Foregate Street, Worcester, 6th July, 1908, Miss Violet Rea.

Easily distinguished from its allies by the red meally granules on the disc and the angularly globose spores.

Coprinus cordisporus Gibbs. Naturalist 1898, p. 100.

Pileus at first cylindric-ovate, then expanded, at length upturned, very thin, plicato-sulcate, splitting along the backs of the gills, margin crenate, 6-9 mm. across, whitish or pallid ochraceous, disc sprinkled with tawny *furfuraceous papillae.* Gills free, but ending close to the stem, rather narrow, 25-30 in number in the larger pilei, intermediate shorter ones few or none. Stem 2 cm. long, filiform, hollow, whitish-hyaline, glabrous except at the base, which is slightly thickened and *densely strigose-squamulose.* Spores dark brown-purple, laterally compressed, front view *obtusely cordate,* 9-10μ diameter, side view elliptical, 5-6μ thick. Cystidia cylindric fusiform $50 \times 10\mu$.

On dung of horse, sheep, rabbit, at Sheffield, Farnley Tyas, and Buckden, West Yorkshire; Wirksworth, Derbyshire.

Distinguished by the persistent furfuraceous papillae on the disc the densely squamulose foot, and the obtusely heart-shaped compressed spores.

HYDNOPSIS Schröt. Pileus resupinatus, effusus. Aculei subulati, gracillimi. Spora fusca vel violacea.

Hydnopsis farinacea Rea, Pl. 7.

Subiculum villoso-intertextum, album. Aculei albi, dein *umbrini,* subdistantes, tenues, acuti. Sporae ellipsoideae, *fuscae,* $6\text{-}7 \times 3\text{-}4\mu$.

Vere, supra folia exsiccata *Fagi,* Swarraton. Legit W. L. W. Eyre.

Very similar to *Hydnum farinaceum* Pers. when quite fresh and white, but easily distinguished at maturity by the teeth becoming darker and the coloured spores. The teeth are 1 mm. long, whitish at first, then wood colour, and finally umber.

Odontia alliacea Weinm.

Broadly effused, incrusting, membranaceous, *white becoming pale,* subiculum villose, *black fibrillose underneath,* silky at the margin. Teeth both short and long intermixed, villose, multifid at the apex. Odour of Garlic.

The above description is a translation of the species as described in Fr. Hym. Europ., p. 628, but it seems that it requires amending in several details first. Although it is a transparent white fungus when gathered in all its freshness it acquires a cinereous tinge with age, and the black underside Monsieur

Boudier (to whom I consigned a portion of the gathering and to whom I am indebted for the determination of the species) considered was due to the fact that it was growing on the top of a black Lichen. So it would seem that this black underside is really not diagnostic of the plant but possibly of its habitat. The teeth are very beautifully incised. Spores white, hyaline, 3-4 × 2μ, and the basidia, according to my observations, have only two sterigmata. The smell is only faint. Mr. D. A. Boyd, Stevenston Wood, Ayrshire, 22nd October, 1908.

Cyphella lactea Bres. Fung. Trident, vol. I., p. 61, Quél. Fl. Myc., p. 27.

Snow white, sessile, membranaceous, cup-shaped, ·5-1 mm. wide and high, tomentose on the outside with shining white *clavate hairs*, margin entire ciliate. Hymenium even, becoming finally cream colour. Spores *ovate-clavate* 9-13 × 3·5-5μ, three to four guttulate.

On dead leaves of *Aira caespitosa*, Tumby, Lincolnshire, Mr. H. C. Hawley, June, 1908.

Easily distinguished by its snow white colour clavate hairs and the ovate-clavate spores.

Hypochnus solani Prill. & Del. in Bull. Soc. Mycol. France, vol. VII., p. 220 (1891).

On the lower portion of living potato-haulms, Mortlake, Surrey, G. Massee. See Journ. Bot. XLVI., p. 151 (1908).

HELICOBASIDIUM Pat., Bull. Soc. Bot. Fr., XXXII., p. 171 (1885). Les Hymenomycètes d'Europe, p. 158. Essai Taxonomique sur les familles et les genres des Hyménomycètes, p. 12; *Hypochnus* Tul., Ann. Sc. Nat., XV.; *Stypinella* Schröt., Schles. Pilze (1889).

Resupinate, effused and variously incrusting, margin indeterminate, fibrillose; hymenium soft, waxy; basidia cylindrical, *more or less incurved, transversely septate*, with subulate sterigmata arising on the convex portion. Spores uncoloured, smooth ovoid.

Helicobasidium purpureum (Tul.) Pat. *Corticium lilacinum* Quél. Fl. Myc. p. 9. See pl. 7 hereof.

Broadly effused, incrusting, indeterminate, adnate, hymenium, dingy reddish purple, paler at the margin, ultimately of a deep vinous colour and covered with a white pruina. Spores white, hyaline, pear-shaped, 10-12 × 6-8μ.

On a half buried *Ash bough* amongst leaf debris under an Ash

tree on the lawn at Swarraton Rectory, Hants., 17th March, 1908, Rev. W. L. W. Eyre.

This pretty vinous coloured species looks like a *Corticium* but is easily recognized by the curved, transversely septate basidia.

BOVISTELLA Morgan. Like *Bovista* in having free capillitium threads but distinct in having a sterile basal portion. G. C. Lloyd, in Mycological Notes, No. 23, p. 277, emends Morgan's definition of the genus as follows:—"Peridium flaccid, with or without a sterile base, opening by a definite mouth. Capillitium of short, separate threads, or long intertwined threads. Spores pedicellate."

Bovistella paludosa (Lév.) Lloyd. Lév. Ann. des. Sci. Nat. Ser. III. V. V., p. 163 (1846). Calvatia paludosa Sacc. Lloyd, M. N., p. 280, Pl. 87, and see Pl. 8 hereof.

Subglobose, 3 cm. wide and high, pale yellow tinged with reddish brown, plicate below, and contracted into a well developed, distinct stalk which is internally minutely cellular and sterile. Exoperidium very thin, pale ochre (like a coat of whitewash) gradually disappearing. Sterile base well developed. Gleba dark olive. Capillitium of separate, branched threads which taper to a point and are from 3-4μ wide at their thickest part, the main stems are 9-12μ thick, yellowish, as are the branches with deeper coloured walls to the hyphae. Spores olive, globose, $\times$ 4-5μ, smooth, with long, hyaline, slender pedicels 9-10μ.

On the Moors, Cleveland Hills, near Osmotherley, Yorkshire, 5th August, 1908.

Our member, Mr. T. Gibbs, kindly sent on this specimen to me in August last, which was collected by one of the Yorkshire members at the meeting, and I at once recognised the fact that it was a *Bovistella* as defined by Morgan, but as I knew our member Mr. G. C. Lloyd had had the privilege of seeing and examining the exsiccati of Europe and America I thought that it was only right that I should submit it to him for his determination, and I gratefully acknowledge his kindness in so doing. This is a rare species and has only once before been met with by Léveillé, at Malesherbes, France, in 1845. Two specimens of this collection are in the Museum at Paris and one at Kew.

Helotium tetraascosporum Rea.

Ascomata stipitata, cupuliformia, 1·5-2 mm. alta, ·5 mm. lata, disco ochraceo extus pallidiora, glabra, marginibus inflexis. Substantia subconcolor, ceraceo-subgelatinosa. Asci clavati, iodio haud tincti, *constanter 4-spori*, 125-130 $\times$ 8-9μ, paraphyses

filiformes, septatae, ramosae, apice leniter subincrassatae 145-155 × 1-1·5μ; sporae oblongo-ellipticae, hyalinae, primo continuae, terguttulatae, monostichae dein in maturo distichae, *biseptatae* 21-27 × 3·5-4·5μ.

Ad caules siccos *Phalaridis arundinaceae* prope Perth, October, 1908. Legit James Menzies.

This Helotium is easily recognized by its four-spored asci and biseptate spores. Specimens were submitted to our member Monsieur Emile Boudier, who agreed that it was an undescribed *Helotium*.

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Published 31st March, 1909.

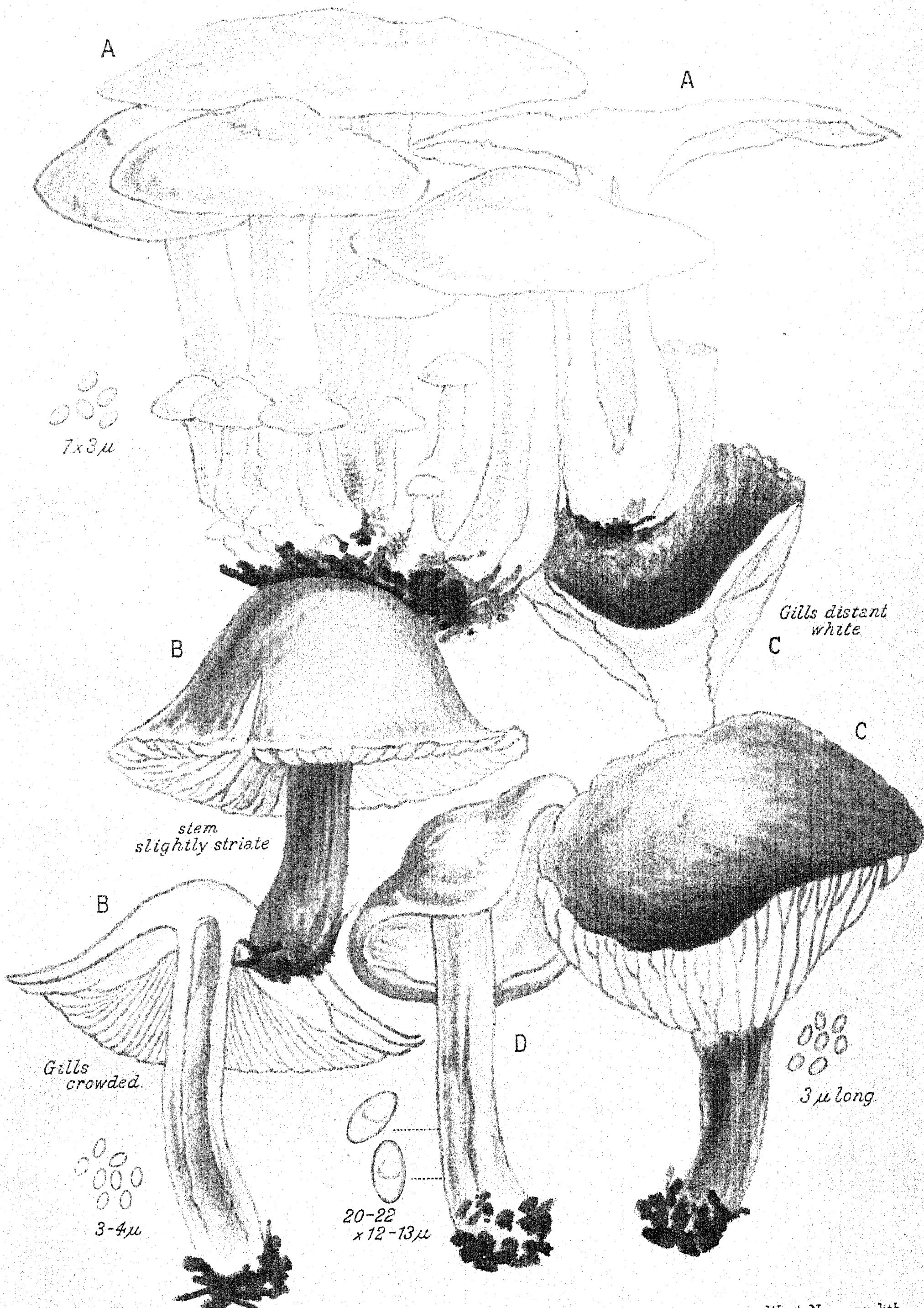
A. D. Cotton del. West, Newman proc.

MYCOSPHAERELLA ASCOPHYLLI *Cotton.*

E. Boudier del. West, Newman proc.

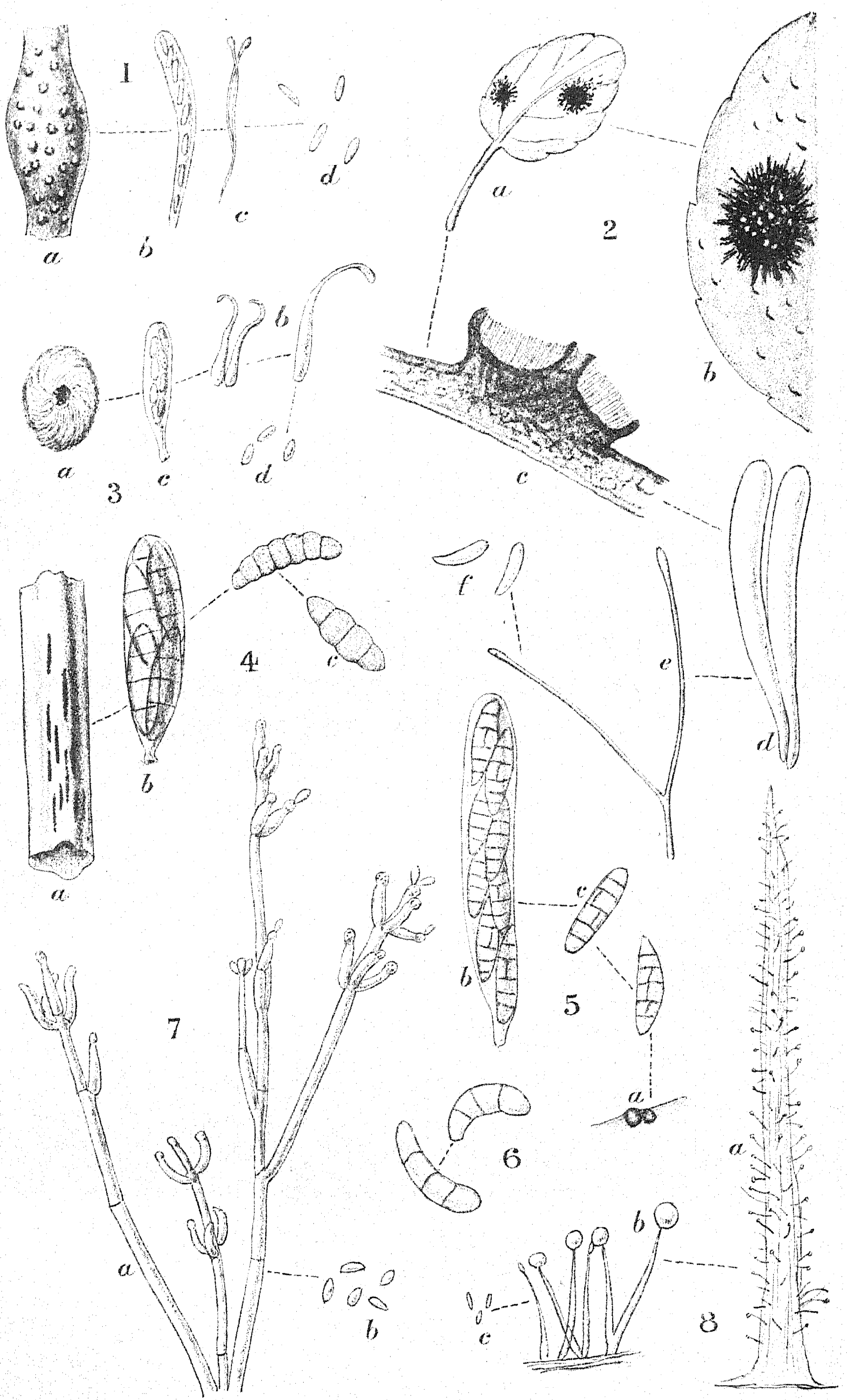
PSEUDOPHACIDIUM SMITHIANUM *Boud.*

a. Petite branche d'Empetrum nigrum envahie par le Pseudophacidium Smithianum. Grand. Natur.
b. Feuille d Empetrum portant 5 cupules de Pseudophacidium grossie 5 fois.
c. Coupe d'une autre au même grossissement.
d. Une cupule isolée grossie 30 fois.
e. Coupe d'une autre au même grossissement.
f. Theque et paraphyses jeunes, 475 diamètres.
g. Theque et paraphyses agées, même grossissement.
h. Spores jeunes grossies 820 fois.
i. Spores agées au même grossissement.

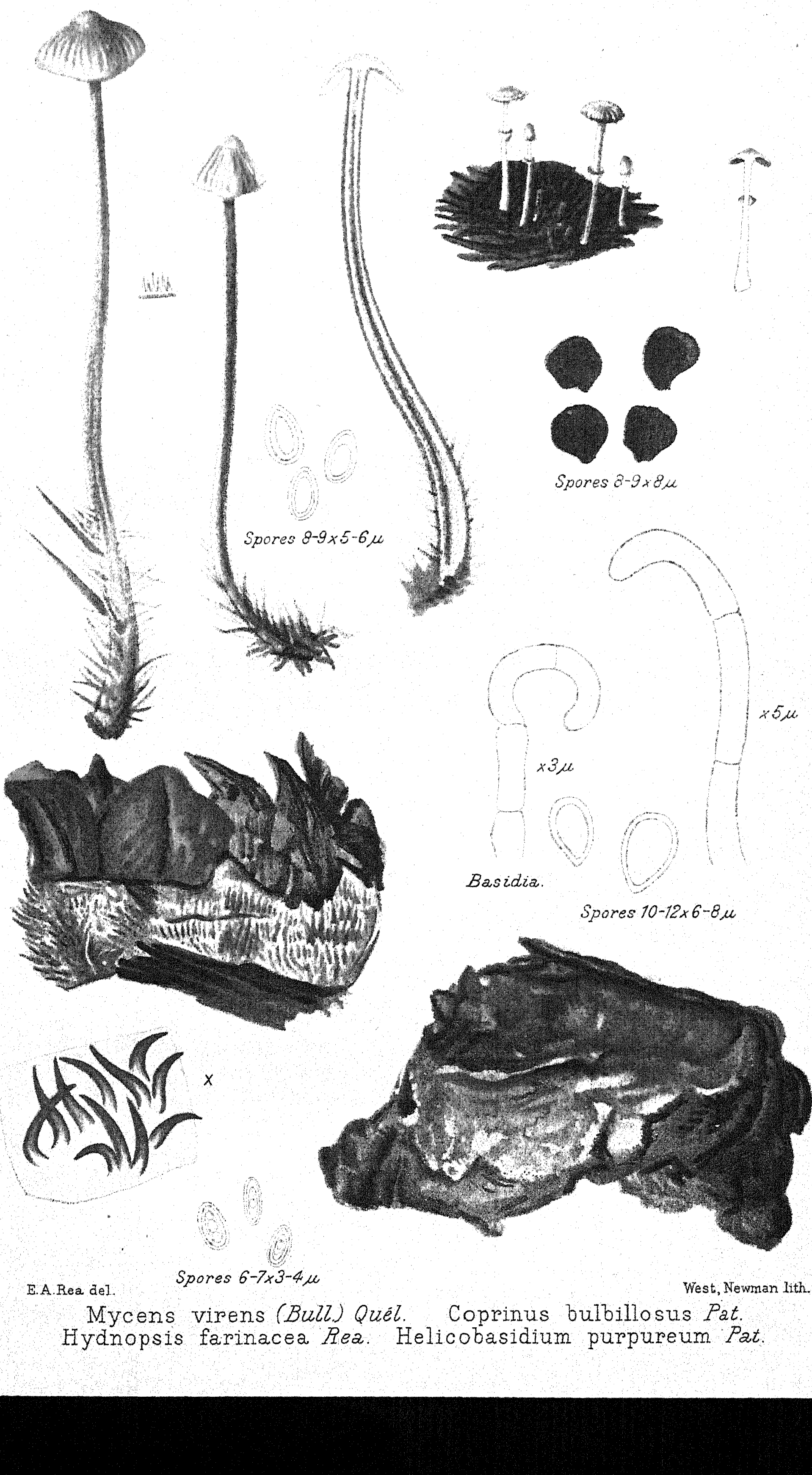


M. C. Cooke del. West, Newman lith.

A. Clitocybe connata *Schum.* C. Clitocybe obscurata *Cke.*
B. Collybia dryophila *Bull.* var. alvearis *Cke.* D. Helvella guepinioides *B. & Cke.*

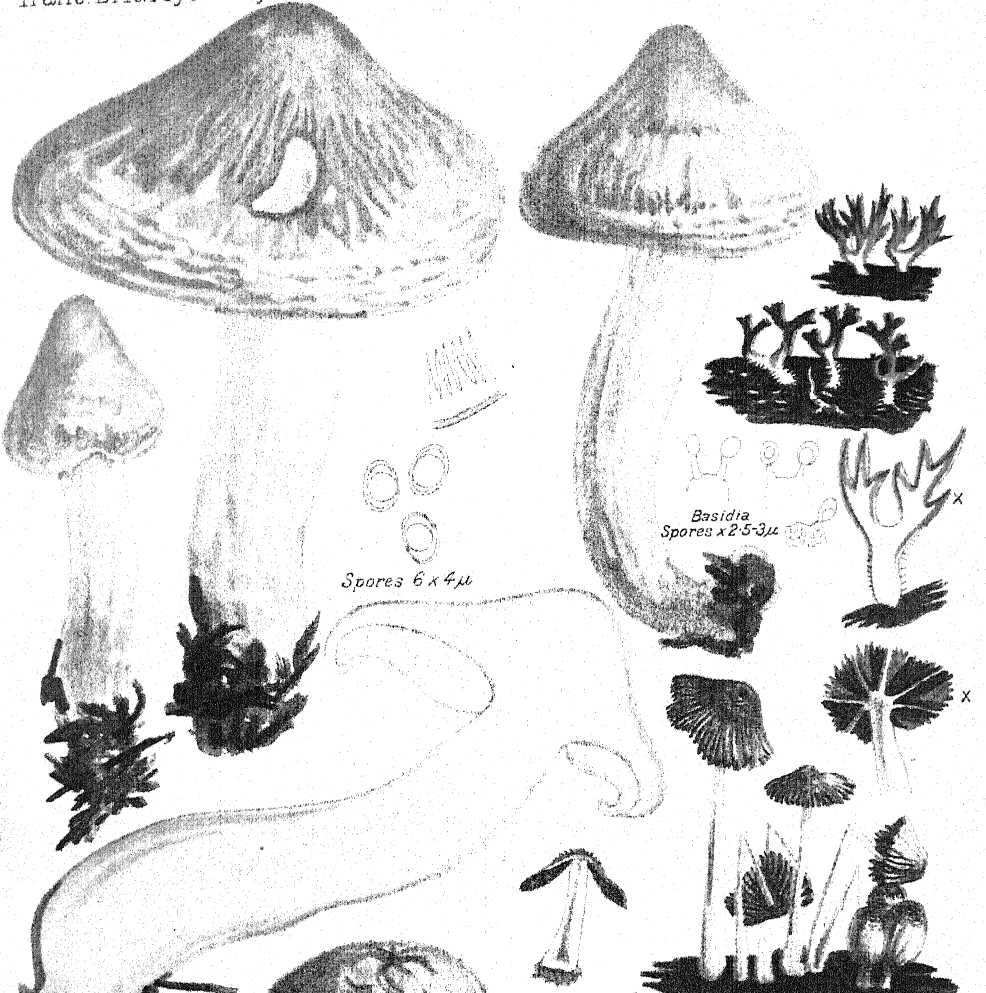


A. L. S. del. Highley, lith. J. Pitcher & C° L^td imp.



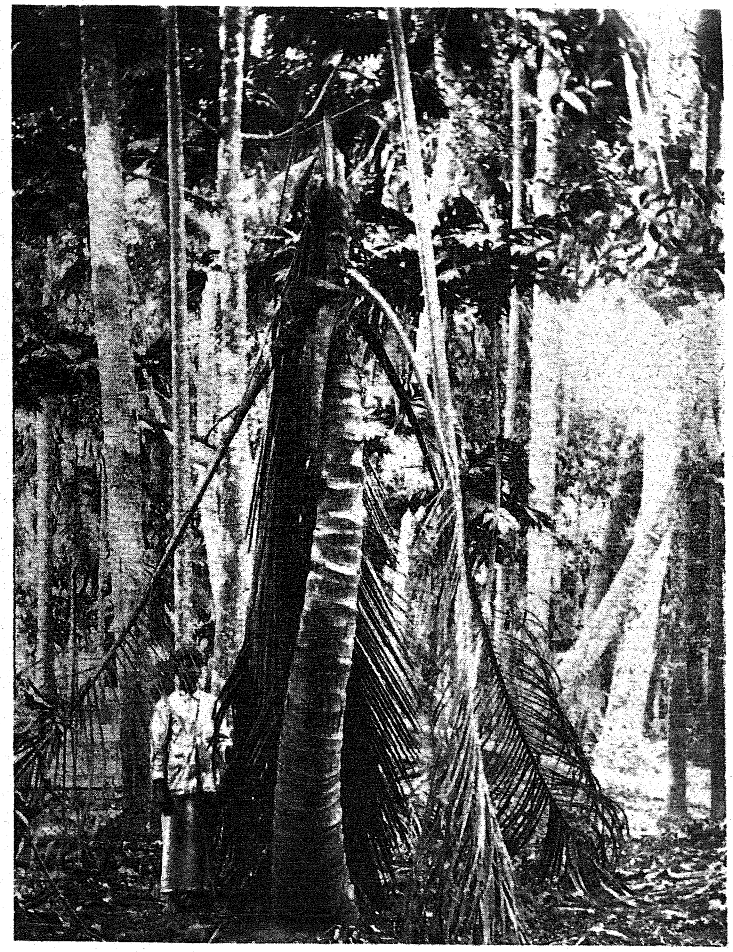
E. A. Rea del. West, Newman lith.

Mycens virens *(Bull.) Quél.* Coprinus bulbillosus *Pat.*
Hydnopsis farinacea *Rea.* Helicobasidium purpureum *Pat.*



E. A. Rea del. West, Newman lith.

Tricholoma luteocitrinum *Rea*. Clavaria conchyliata *Allen*.
Bovistella paludosa *(Lév.)* Coprinus Patouillardii *Quél*. Lepiota irrorata *Quél*.



T. Petch photo.

A B

THE BLEEDING DISEASE OF THE COCOA-NUT PALM (*Thielaviopsis ethacetica* Went.

West, Newman proc.

THE SHREWSBURY SPRING FORAY.

28th May to 1st June, 1909.

The British Mycological Society held an informal Spring foray at Shrewsbury from Friday the 28th of May to Tuesday the 1st of June. The members assembled at the George Hotel, Shrewsbury, on the Friday evening and expeditions were made on the following days to Linley station for the Caughley Woods and Tickwood; to Longden Manor for Lincroft Pool and Oak Hill Wood; to Bayston Hill for Bomere and Shomere Pools and to Haughmond Abbey and the adjoining woods. At Caughley Wood Mr. C. J. Sharpe detected some nice examples of *Geopyxis parvispora* Mass. and Mr. W. B. Allen gathered several sporangia of the somewhat rare *Hemitrichia clavata* Rost. The President (Professor M. C. Potter, Sc.D., M.A., F.L.S.) was also interested in obtaining some specimens of *Stilbum tomentosum* Schrad. The woods surrounding Bomere and Shomere yielded quite a large crop of Agarics, including *Omphalia striaepilea* Fr., *Naucoria myosotis* Fr., *Tubaria stagnina* Fr. and *Pluteus salicinus* (Pers.) Fr. And the rushes in a bog near to Bomere Pool were found infected with the ascophores of *Sclerotinia Curreyana* (Berk.) Karst. At Haughmond woods Mr. W. B. Allen secured a solitary specimen of *Collybia laxipes* Fr. and Dr. H. C. I. Fraser, D.Sc., F.L.S., pointed out some small perithecia of *Nectria sanguinea* (Sibth.) Fr. Mr. James Menzies sent to the foray from the neighbourhood of Perth some very interesting Ascomycetes, including *Gymnoascus ruber* van Tiegh., *Sepultaria semiimmersa* (Karst.) Mass., *Vibrissea Guernisaci* Crouan, *Sclerotinia Curreyana* (Berk.) Karst., *Dasyscypha nidulus* (Schmidt & Kunze) Mass. and *Cenangium pulveraceum* (A. & S.) Fr.

Over one hundred and ninety-four species were collected during the foray, consisting of one hundred and seventy-four fungi and twenty mycetozoa. This satisfactory result was due entirely to the excellent arrangements that our fellow-member Mr. W. B. Allen had made. Our best thanks are due to him and to Mr. H. E. Forrest for their able leadership and assistance in the field and to the following landowners and tenants for kind permission to visit their estates:—Messrs. G. P. Heywood, E. B. Fielden and H. D. Corbet.

The thanks of the Society are also accorded to the Caradoc Society for placing their Club Room and microscopes at our disposal.

55

COMPLETE LIST OF FUNGI GATHERED DURING THE FORAY.

Armillaria mellea (Fl. Dan.) Fr.
Tricholoma saponaceum Fr.
Collybia platyphylla Fr., fusipes (Bull.) Fr., laxipes Fr.
Mycena rugosa Fr., galericulata (Scop.) Fr., polygramma (Bull.) Fr., filopes (Bull.) Fr., acicula (Schaeff.) Fr.
Omphalia striaepilea Fr., umbellifera (Linn.) Fr., fibula (Bull.) Fr.
Pluteus cervinus (Schaeff.) Fr., salicinus (Pers.) Fr.
Nolanea pascua (Pers.) Fr.
Pholiota praecox (Pers.) Fr., mutabilis (Schaeff.) Fr.
Naucoria semiorbicularis (Bull.) Fr., myosotis Fr.
Pluteolus aleuriatus Fr.
Galera tenera (Schaeff.) Fr., hypnorum (Schrank) Fr.
Tubaria stagnina Fr., furfuracea (Pers.) Fr.
Stropharia semiglobata (Batsch) Fr.
Hypholoma sublateritium Fr., epixanthum (Paul.) Fr., fasciculare (Huds.) Fr., appendiculatum (Bull.) Fr., hydrophilum (Bull.) Quél.
Coprinus micaceus (Bull.) Fr.
Bolbitius titubans (Bull.) Fr.
Paxillus involutus (Batsch) Fr.
Lactarius quietus Fr.
Russula adusta (Pers.) Fr.
Panus stipticus (Bull.) Fr.
Polyporus betulinus (Bull.) Fr., cuticularis (Bull.) Fr., hispidus (Bull.) Fr., adustus (Willd.) Fr., chioneus Fr., sulphureus (Bull.) Fr., squamosus (Huds.) Fr., brumalis (Pers.) Fr.
Fomes annosus Fr., applanatus (Pers.) Wallr., fomentarius (Linn.) Fr., igniarius (Linn.) Fr.
Polystictus versicolor (Linn.) Fr., abietinus (Dicks.) Fr., radiatus (Sow.) Fr.
Poria vulgaris Fr., vitrea Pers., vaporaria Pers., ferruginosa Schrad., blepharistoma (B. & Br.) Cke.
Trametes rubescens (A. & S.) Fr.
Daedalea confragosa (Bolt.) Pers.
Solenia fasciculata Pers., anomala (Pers.) Fckl.
Hydnum farinaceum Pers.
Irpex obliquus (Schrad.) Fr.

Grandinia granulosa (Pers.) Fr., mucida Fr.
Thelephora laciniata Pers.
Stereum purpureum Pers., hirsutum (Willd.) Pers., spadiceum (Pers.) Fr., sanguinoleutum (A. & S.) Fr., rugosum Pers.
Hymenochaete rubiginosa (Dicks.) Lév.
Corticium calceum (Pers.) Fr., lacteum Fr., nudum Fr., Sambuci Pers., caeruleum (Schrad.) Fr.
Peniophora velutina (D.C.) Cke.
Coniophora umbrina (A. & S.) Karst.
Tremella mesenterica Retz.
Exidia albida (Huds.) Bref., glandulosa (Bull.) Fr.
Auricularia auricula-Judae (Linn.) Pat.
Bovista nigrescens Pers.
Ithyphallus impudicus (Linn.) Fisch.
Crucibulum vulgare Tul.
Ustilago longissima (Sow.) Tul., violacea (Pers.) Tul.
Plasmodiophora alni (Woronin) Moell.
Uromyces ficariae (Schum.) Lév., dactylidis Otth., poae Rabh.
Puccinia malvacearum Mont., suaveolens (Pers.) Wint., fusca (Relhan) Wint., primulae (DC.) Wint., violae (Schum.) Wint., glumarum Schmidt., caricis (Schum.) Wint., pringsheimiana Kleb., lychnidearum Link., betonicae (A. & S.) Wint.
Triphragmium ulmariae (Schum.) Wint.
Phragmidium subcorticatum (Schrank.) Wint.
Melampsora rostrupii Wagner.
Coleosporium senecionis (Pers.) Wint.
Sphaerotheca pannosa (Wallr.) Lév.
Erysiphe graminis DC.
Nectria cinnabarina (Tode) Fr., coccinea (Pers.) Fr., sanguinea (Sibth.) Fr., episphaeria (Tode) Fr.
Hypomyces rosellus (A. & S.) Tul.
Hypocrea rufa (Pers.) Fr.
Epichloe typhina (Pers.) Tul.
Leptospora spermoides (Hoffm.) Fckl., ovina (Pers.) Fckl.
Bertia moriformis (Tode) de Not.
Melanomma pulvis-pyrius (Pers.) Fckl.
Leptosphaeria acuta (Moug. & Nestl.) Karst.
Hypospila pustula (Pers.) Karst.
Valsa lata (Pers.) Nitschke.
Quaternaria Persoonii Tul.
Diatrypella quercina (Pers.) Nitschke.
Diatrype stigma (Hoffm.) de Not., disciformis (Hoffm.) Fr.
Hypoxylon multiforme Fr., fuscum (Pers.) Fr., coccineum Bull.
Daldinia concentrica (Bolt.) Ces. & de Not.
Ustulina vulgaris Tul.

Xylaria hypoxylon (Linn.) Grev.
Dothidella betulina (Fr.) Sacc.
Rhopographus pteridis (Sow.) Wint.
Dichaena quercina (Pers.) Fr.
Trochila ilicis (Chev.) Crouan.
Colpoma quercina (Pers.) Wallr.
Rhytisma acerinum (Pers.) Fr.
Bulgaria polymorpha (Fl. Dan.) Wettstein.
Ombrophila brunnea Phill.
Orbilia xanthostigma Fr.
Mollisia cinerea (Batsch) Karst.
Helotium virgultorum (Vahl.) Karst., calyculus (Sow.) Berk., herbarum (Pers.) Fr., fagineum (Pers.) Fr.
Sclerotinia Curreyana (Berk.) Karst.
Chlorosplenium aeruginosum (Oed.) de Not.
Lachnea scutellata (Linn.) Gill., livida (Schum.) Phill.
Dasyscypha virginea (Batsch) Fckl., nivea (Hedw. fil.) Mass., aspidiicola (B. & Br.) Sacc., hyalina (Pers.) Mass., calycina (Schum.) Fckl.
Geopyxis parvispora Mass.
Pyronema omphalodes (Bull.) Sacc.
Humaria granulata (Bull.) Quél.
Peziza sepiatra Cke.
Spinellus fusiger (Link) van Tiegh.
Sporodinia grandis Link.
Cystopus candidus (Pers.) Lév.
Plasmopara nivea (Unger) Schröt. On *Aegopodium Podagraria*
Peronospora parasitica (Pers.) Tul. On *Rhinanthus Crista-galli*
Phoma samarorum Desm., nebulosum (Pers.) Berk.
Oidium balsamii Mont.
Penicillium glaucum Link.
Rhinotrichum niveum Cke & Mass.
Botrytis vulgaris Fr.
Zygodesmus fuscus Cda.
Stilbum tomentosum Schr.
Stysanus stemonitis Cda.
Bactridium flavum Kunze & Schw.

Mycetozoa.

Ceratiomyxa mucida Schröt.
Badhamia utricularis Berk.
Physarum nutans Pers.
Chondrioderma radiatum Rost.

Didymium effusum Link.
Stemonitis fusca Roth.
Comatricha obtusata Preuss.
Reticularia Lycoperdon Bull.
Lycogala miniatum Pers.
Trichia affinis de Bary, persimilis Karst., varia Pers., fallax Pers.,
Botrytis Pers.
Hemitrichia rubiformis List., clavata Rost.
Arcyria ferruginea Saut., punicea Pers., incarnata Pers.
Perichaena populina Fr.

THE BASLOW FORAY.

27th September to the 2nd October, 1909.

The thirteenth annual week's fungus foray of the British Mycological Society was held at Baslow, Derbyshire, for the investigation of the Chatsworth and adjoining woods. On Monday, the 27th of September, 1909, the members assembled at the headquarters, The Grand Hotel and Hydro at Baslow, and the proprietor, Mr. R. H. Mabbott, kindly placed at their disposal the large recreation room for the exhibition of fungi, the reading of papers, and the transaction of the Society's business. On this occasion the British Mycological Society were greatly honoured by the attendance of the well-known French mycologists Professeur René Maire, D.Sc. (Maitre de Conférences de Botanique a la Faculté des Sciences Caen), Monsieur E. Peltereau (Notaire honoraire et Trésoir de la Société Mycologique de France Vendôme) and Monsieur and Madame E. Simon, Paris, and we are greatly indebted to their kind assistance in the determination of many of the more critical species enumerated in the subjoined list. On the previous day a few early arrivals worked The Yeld Wood at the back of The Grand Hotel, the adjoining pastures, and a fir wood that bordered Bar Brook. In the Yeld Wood specimens of *Corticium atrovirens* Fr. and *Entoloma pulvereum* Rea were collected, and in the pastures *Collybia vertirugis* Cke. was very abundant, and Mr. W. B. Allen gathered *Nolanea rufocarnea* Berk., and a form of *Leptonia serrulata* (Pers.) Fr. that exactly agreed with Cooke's Illustration number 333 and which was painted by Berkeley from specimens collected at Spondon, Derbyshire. The most noteworthy plants found in the fir wood were *Entoloma nigrocinnamomeum* Kalchbr. and *Poria terrestris* (DC.) Fr. and the mycetozoon *Physarum Diderma* Rost.

It had been proposed in the programme for this foray that the members should divide up on the Tuesday into two sections but as the members present thought that this course was not a desirable one it was decided that one portion only should be explored on the Tuesday. In pursuance of this resolution the members drove from the headquarters at 11 o'clock on Monday, the 27th of October, 1909, to Grindleford Bridge, where they were met by Mr. E. Sharman. Sheriff's Wood was carefully

searched but there were few fungi of interest about with the exception of *Panus torulosus* (Pers.) Fr., which the President (Professor M. C. Potter) photographed in situ. Mr. W. B. Allen and other members were more fortunate with the mycetozoa, and their labours resulted in several interesting records, including *Lamproderma echinulatum* Rost. (fourth record for Britain), *Stemonitis flavogenita* Jahn, *Cribraria rufescens* Pers., *Lepidoderma tigrinum* Rost., and *Enteridium olivaceum* Ehrenb. The road to the west of Sheriff's Wood was next taken and on its banks a few examples of *Clavaria argillacea* (Pers.) Fr. were secured, and Mrs. Carleton Rea found an undescribed yellow *Hygrophorus*, which was subsequently named *Hygrophorus citrinus* Rea. A traverse across the fields in the direction of Highlow Wood also rewarded Miss Eyre with a pretty deep blue *Leptonia* new to science, which has since been called *Leptonia Reaae* Maire. In Highlow Wood the somewhat rare *Fuligo muscorum* A. & S. and *Entoloma Bloxami* B. & Br. were noticed. On the Monday evening many species of fungi were placed out on exhibition in the recreation room, and the following members had kindly brought or sent to the foray some interesting plants:—Monsieur René Maire *Omphalia graveolens* Maire from the neighbourhood of Lunéville and *Clitocybe ericetorum* (Bull.) Fr. from Richmond Park; the Rev. W. L. W. Eyre *Eccilia carneogrisea* B. & Br. and *Nolanea pisciodora* (Ces.) Fr., from Swarraton; Miss A. Lorrain Smith *Hydnotrya Tulasnei* B. & Br., from Arran; Rev. David Paul *Clavaria stricta* Pers. and *Thelephora cristata* (Pers.) Fr., from Scotland; Mr. J. F. Rayner *Hexagonia apiaria* Fr., from India; Mr. W. B. Allen *Naucoria siparia* Fr., *Lepiota lenticularis* (Lasch.) Fr., *Inocybe Godeyi* Gill., *Fomes lucidus* (Leys.) Fr., *Polyporus rufescens* (Pers.) Fr., (=*Daedalea biennis* (Bull.) Quél) and *Peziza vesiculosa* Bull. from Benthall; Mr. A. D. Cotton *Hydnum cinereum* Bull. Dr. A. Adams *Craterellus lutescens* (Pers.) Fr., *Lepiota acutesquamosa* (Weinm.) Fr., *Mycena flavoalba* (Bolt.) Fr., *Flammula Tricholoma* (A. & S.) Karst. and *Geaster fimbriatus* Fr. from Savernake Forest. Miss E. J. Welsford *Schizophyllum commune* Fr. from Canada, and the Hon. Secretary *Choiromyces meandriformis* Vitt. found by Mrs. Carleton Rea in Wyre Forest ,Worcestershire.

On Tuesday, the 28th September, the morning was wet and was devoted to the elucidation of the specimens already collected. At 12 o'clock the members left the headquarters and drove to a wood yard close to Grindleford railway station where examples of *Ulocolla foliacea* (Pers.) Bref., *Cribraria aurantiaca* Schrad., and *Cribraria argillacea* Pers. were obtained. Bolehill Wood was next entered, but although the undergrowth was very rank many plants worthy of record were noticed, namely, *Naucoria*

camerina Fr. (first record for Britain), *Collybia mephitica* Fr., *Collybia coracina* Fr., *Cortinarius (Hydrocybe) uraceus* Fr., *Lactarius trivialis* Fr., *Stereum gausapatum* Fr. (first record for Britain), *Cortinarius (Telamonia), glandicolor* Fr., *Dacryomitra (=Calocera) glossoides* (Pers.) Bref., *Rhizina inflata* (Schaeff.) Karst. and *Helotium aureum* Pers. The road leading to Sheffield was followed for a short distance and Sheffield plantation and the adjoining park were hurriedly examined and yielded specimens of *Nolanea exilis* Fr., *Lactarius flexuosus* Fr., *Galera Sahleri* Quél. (first record for Britain), *Marasmius foetidus* (Sow.) Fr., *Hygrophorus sciophanus* Fr. and *Exobasidium vaccinii* Woronin. The President (Professor M. C. Potter, Sc.D., M.A., F.L.S.) took the chair at the evening meeting at 8.30, when the following officers were unanimously elected for the ensuing year:—Mr. Harold Wager, F.R.S., F.L.S., President; Professor R. H. Biffen, M.A., Vice-President; and Mr. Carleton Rea, B.C.L., M.A., Hon. Secretary and Treasurer. The Hon. Secretary reported that he had received an invitation from the Chester Society of Natural Science, Literature and Art to hold their next annual foray at Chester and that they would place a room at their disposal at the Museum suitable for the display of specimens and the reading of papers. Dr. C. Theodore Green, M.R.C.S., L.R.C.P., F.L.S., urged the members to favourably consider this proposal, saying that Chester would be an excellent centre for working Delamere Forest and also would provide ample Hotel accommodation. The invitation was unanimously accepted and the date was afterwards to be decided by the officers of the Club in conjunction with Dr. C. Theodore Green, and it was also resolved that the spring foray should be held at Whitsuntide next in Delamere Forest. The Hon. Secretary was appointed delegate to represent the British Mycological Society at the meeting of the British Association at Sheffield in 1910, and the study of mycology from an economic standpoint was suggested as a subject for their consideration. The Hon. Treasurer reported that the sum of £25. 7s. 4d. now stood to their credit at the post office savings bank and that seven new members had been elected since the last autumn foray, namely, Mr. A. W. Oke, B.A., L.L.M., F.G.S., F.L.S., 32 Denmark Villas, Hove; Lieutenant-Colonel K. R. Kirtikar, F.L.S., Member of the Association International des Botanists (Holland), M.R.C.S., L.R.C.P., Alexandra Lodge, Post Andheri (Thana District), near Bombay, India; Rev. A. H. Moore, St. Winefride's, Welshpool; Mr. I. Watkin, 1 Brighton Place, Oak Street, Oswestry; Miss A. Taylor, Brookfield, Emsworth, Hants; and Monsieur E. Peltereau (Notaire honoraire et Trésoir de la Société Mycologique de France. He also announced that Dr. M. C. Cooke had most generously given to the British Mycologi-

cal Society a copy of his fine illustrations of the British Cortinarii, and it was resolved that their warmest thanks should be tendered to him for his kind gift. Miss Sibyl Longman, of Upp Hall, Braughing, Ware, was unanimously elected a member.

On Wednesday, the 29th of September, the forenoon was occupied in the investigation of the fungi gathered on the previous day, and at 12 o'clock the members entered the carriages for Bakewell Bridge, where they were met by Mr. G. Twyford (Forester to the Duke of Rutland). Mr. Twyford led the members up a hill in the direction of Manners Wood, and by the roadside a fine clump of *Pholiota adiposa* Fr. attracted their attention. In Manners Wood some specimens of *Pholiota erebia* Fr. were detected growing amongst Claytonia sibirica, and at the south end of the wood Dr. A. Adams gathered on a pollard an *Omphalia* with bright yellow gills, and this has since been described as *Omphalia Allenii* Maire. Mr. W. B. Allen also found *Peziza linteicola* Phil. & Plow. growing on an old sack, and some twigs and leaves rewarded him with *Physarum contextum* Pers. and *Comatricha Persoonii* Rost. The walk was then continued to Rowsley, where the carriages were re-entered for the return drive. In the evening, at 8.30, Professor M. C. Potter, Sc.D., M.A., F.L.S., delivered his presidential address entitled "Bacteria in their relation to plant pathology" (see page 150), and Dr. C. Theodore Green, M.R.C.S., L.R.C.P., F.L.S., placed on the screen a few of his life-like coloured slides of some of the larger fungi.

On Thursday, the 30th of September, the members were busy in the recreation room all the morning, and it was past mid-day before they drove off to the wood yard at the south end of Chatsworth Park. From this wood yard Dr. Wrench, M.V.O., led them into the Old Oak Park, where the following interesting plants were collected:—*Polyporus frondosus* (Fl. Dan.) Fr., *Hygrophorus vitellinus* Fr., *Clitocybe connata* (Schum.) Fr., *Cortinarius (Telamonia) ileopodius* (Bull.) Fr., *Cortinarius (Hydrocybe) saturninus* Fr., *Nolanea versatilis* Fr. (first record for Britain), *Russula azurea* Bres. and *Inocybe haemacta* B. & Cke. A timber yard at the back of Chatsworth House was next carefully examined, and from thence the members walked back across the Park to Baslow. In the evening, at the conclusion of dinner, the President proposed in felicitous terms the health of their illustrious French colleagues and coupled with it a toast to the entente cordiale. These were drunk with great enthusiasm, and Monsieur René Maire replied in a very eloquent speech, in which he advocated the international investigation of fungi, which alone would enable them to appreciate and understand their varied forms. Afterwards, at 8.30, Monsieur René Maire gave a very lucid address on the RUSSULAE, which is

embodied in his paper (see page 189), and Mr. A. D. Cotton, F.L.S., followed with some notes on "New or critical British Clavariae" (see page 179). In conclusion, Dr. C. Theodore Green, M.R.C.S., L.R.C.P., F.L.S., passed through the lantern a large number of his beautifully coloured slides of the Basidiomycetae.

On Friday, the 1st of October, the morning was spent in the determination and study of the critical species, and at about 12.30 the members drove to the stables at Chatsworth House. Here they were met by Mr. J. P. Robertson, who conducted them through the extensive gardens, and their investigation occupied the rest of the day. The fungi most worthy of record were *Lactarius fluens* Boud. (first record for Britain) found by Monsieur E. Peltereau, *Nolanea papillata* Bres., *Nolanea araneosa* Quél. (first record for Britain) collected by Miss Eyre, *Leptonia asprella* Fr., *Nolanea versatilis* Fr., *Russula grisea* (Pers.) Fr. (first record for Britain), gathered by Mr. A. D. Cotton, *Russula subfoetens* W. G. Sm., *Cantharellus amethysteus* Quél. (first record for Britain), *Tilachlidium subulatum* A. L. Sm., and a pretty little red *Hygrophorus* with a bitter taste new to science, which was subsequently named *Hygrophorus Reai* Maire.

In the evening the Rev. W. L. W. Eyre, M.A., presided over the final meeting of the session. Hearty votes of thanks were passed to The Duke of Devonshire, The Duke of Rutland, Colonel R. Athorpe, and Messieurs M. J. Hunter and E. A. J. Maynard for kind permission to visit their estates; to Messieurs E. Sharman, G. Twyford, J. P. Robertson and Dr. Wrench for so kindly conducting them in the field, and to their fellow member Mr. Thomas Gibbs (who had suggested the present foray in Derbyshire) for all the trouble and care that he had taken in arranging the details of their programme. The Rev. Eyre, on behalf of the Society, tendered to Mrs. Carleton Rea their warmest thanks for her kind help in executing so many valuable paintings of fungi, which had been reproduced in their Transactions, and thought that such a labour of love should be duly acknowledged. Monsieur Eugene Simon, 10 Villa Said, Paris, the well-known arachnologist, was then unanimously elected a member. A few members remained on at Baslow after the meeting and in the pastures beyond the Yeld Wood discovered specimens of *Cantharellus umbonatus* (Gmel.) Fr., *Mitrula olivacea* (Pers.) Sacc., and an undescribed *Entoloma* bearing a superficial resemblance to *Tricholoma carneum* (Bull.) Fr., which has since been described as *Entoloma griseo-cyaneum* Fr. var. *roseum* Maire. Miss A. Lorrain Smith subsequently reported that she had gathered at the foray *Phlyctaena Pseudophoma* Sacc. (new to Britain), and Mr. Charles Crossland, F.L.S., in

company with Mr. T. Hey, collected near Grindleford railway station a polypore that Mr. C. G. Lloyd had kindly determined as *Polystictus albidus* (Trog.) Fr. (first record for Britain). Over 533 species of fungi, including ten new to Britain and five new to science and forty mycetozoa, were found at Baslow and the subjoined list is remarkable for the large number of pasture fungi recorded therein.

COMPLETE LIST OF FUNGI GATHERED DURING THE FORAY.

Amanita phalloides (Vaill.) Fr., mappa (Batsch) Fr., muscaria (Linn.) Pers., rubescens Pers.

Amanitopsis vaginata (Bull.) Roze., var. plumbea Schaeff., var. fulva Schaeff.

Lepiota procera (Scop.) Pers., excoriata (Schaeff.) Pers., mastoidea Fr., Friesii (Lasch.) Fr., acutesquamosa (Weinm.) Fr., cristata (A. & S.) Fr., carcharias Pers., granulosa (Batsch) Pers. (and the variety having a purple stem recorded by Fries was obtained amongst *Sphagnum*), amianthina (Scop.) Fr., seminuda (Lasch.) Fr.

Armillaria mellea (Vahl.) Fr.

Tricholoma portentosum Fr., ustale Fr., rutilans (Schaeff.) Fr., columbetta Fr., murinaceum (Bull.) Fr., terreum (Schaeff.) Fr., argyraceum (Bull.) Fr., saponaceum Fr., cartilagineum (Bull.) Fr., cuneifolium Fr., virgatum Fr., carneum (Bull.) Fr., personatum Fr., var. saevum Gillet, nudum (Bull.) Fr., panaeolum Fr., melaleucum (Pers.) Fr., subpulverulentum (Pers.) Fr., sordidum (Schum.) Fr., var. lilaceum Quél.

Clitocybe odora (Bull.) Fr., phyllophila (Pers.) Fr., candicans (Pers.) Fr., connata (Schum.) Fr., infundibuliformis (Schaeff.) Fr., var membranacea Fr., cyathiformis (Bull.) Fr., brumalis Fr., metachroa Fr., ditopa Fr., fragrans (Sow.) Fr., obsoleta (Batsch) Fr.

Laccaria laccata (Scop.) B. & Br., var. amethystina (Vaill.) B. & Br., proxima Boud.

Collybia radicata (Relh.) Fr., platyphylla Fr., fusipes (Bull.) Fr., maculata (A. & S.) Fr., butyracea (Bull.) Fr., velutipes (Curt.) Fr., vertirugis Cke., stipitaria Fr., confluens (Pers.) Fr., cirrhata (Schum.) Fr., tuberosa (Bull.) Fr., dryophila (Bull.) Fr., coracina Fr., mephitica Fr., ambusta Fr.

Mycena Iris, aurantiomarginata Fr., rubromarginata Fr., pura (Pers.) Fr., flavo-alba Fr., luteo-alba (Bolt.) Pers., lactea Pers., polygramma (Bull.) Pers., galericulata (Scop.) Pers., rugosa Fr., atrocyanea (Batsch) Fr., pullata B. & Cke., cinerea Mass. & Crossland, leptocephala Pers., ammoniaca Fr., alcalina Fr., filopes Bull., metata Fr.,

amicta Fr., vitilis Fr., acicula (Schaeff.) Fr., leucogala Cke, galopoda Pers., sanguinolenta (A. & S.) Fr., epipterygia (Scop.) Pers.

Omphalia pyxidata (Bull.) Fr., rustica Fr., umbellifera (Linn.) Fr., Allenii Maire, fibula (Bull.) Fr., var. Swartzii Karst., stellata Fr.

Pleurotus ostreatus (Jacq.) Fr., acerosus Fr., septicus Fr.

Pluteus cervinus (Schaeff.) Fr., var. petasatus Fr., chrysophaeus (Schaeff.) Fr.

Entoloma prunuloides Fr., porphyrophaeum Fr., Bloxami B. & Br., jubatum Fr., griseo-cyaneum Fr., and var. roseum Maire, pulvereum Rea, nigrocinnamomeum Kalchbr., sericeum (Bull.) Fr., nidorosum Fr.

Clitopilus prunulus (Scop.) Fr.

Leptonia lampropoda Fr., placida Fr., lappula Fr., solstitialis Fr., serrulata (Pers.) Fr., Reaae Maire, chalybaea (Pers.) Fr., chloropolia Fr., asprella Fr., sericella (Fr.) Quél.

Nolanea pascua (Pers.) Fr., papillata Bres., pisciodora (Cesati) Fr., rufocarnea Berk., exilis Fr., versatilis Fr., araneosa Quél.

Eccilia atropuncta (Pers.) Fr.

Claudopus variabilis (Pers.) W. G. Smith.

Pholiota erebia Fr., togularis (Bull.) Fr., squarrosa (Müll.) Fr., adiposa Fr., mutabilis (Schaeff.) Fr., marginata (Batsch) Fr.

Inocybe hystrix Fr., cincinnata Fr., haemacta B. & Cke., fastigiata (Schaeff.) Fr., Godeyi Gillet, praetervisa Bres., rimosa (Bull.) Fr., asterospora Quél., geophylla (Sow.) Fr., var violacea Pat., petiginosa (Fr.) Quél.

Hebeloma fastibile Fr., glutinosum (Lindgr.) Fr., mesophaeum Fr., sinapizans Fr., crustuliniforme (Bull.) Fr.

Flammula Tricholoma (A. & S.) Karst., lenta (Pers.) Fr., carbonaria Fr., inopoda Fr., sapinea Fr., ochrochlora Fr.

Naucoria melinoides (Bull.) Fr., badipes Fr., cucumis (Pers.) Fr., scolecina Fr., camerina Fr., escharoides Fr.

Galera tenera (Schaeff.) Fr., ovalis Fr., hypnorum (Schrank) Fr., var. sphagnorum (Pers.) Fr., Sahleri Quél.

Tubaria furfuracea (Pers.) W. G. Smith, paludosa Fr., inquilina (Fr.) W. G. Smith.

Agaricus campestris Linn., arvensis Schaeff., haemorrhoidarius Kalchbr.

Stropharia aeruginosa (Curt.) Fr., albo-cyanea (Desm.) Fr., inuncta Fr.. squamosa (Pers.) Fr., semiglobata (Batsch) Fr., stercoraria Fr.

Hypholoma capnoides Fr., epixanthum (Paul.) Fr., fasciculare (Huds.) Fr., dispersum Fr., velutinum (Pers.) Fr., pyrotrichum (Holmsk.) Fr., cascum Fr., appendiculatum (Bull.) Fr., hydrophilum (Bull.) Fr.

Psilocybe sarcocephala Fr., subericaea Fr., uda (Pers.) Fr., semilanceata Fr., var. caerulescens Cke., coprophila (Bull.) Fr., physaloides (Bull.) Fr., foenisecii (Pers.) Fr.
Psathyra corrugis (Pers.) Fr., spadiceo-grisea (Schaeff.) Berk., fibrillosa (Pers.) Fr., pennata Fr.
Anellaria separata (Linn.) Karst.
Panaeolus retirugis Fr., papilionaceus (Bull.) Fr., campanulatus (Linn.) Fr.
Psathyrella gracilis (Pers.) Fr., atomata Fr.
Coprinus comatus (Fl. Dan.) Pers., atramentarius (Bull.) Fr., niveus Pers., micaceus (Bull.) Fr., lagopus Fr., radiatus (Bolt.) Fr., Gibbsii Mass & Crossland,, cordisporus Gibbs, plicatilis (Curt.) Fr., hemerobius Fr.
Bolbitius vitellinus (Pers.) Fr., fragilis (Linn.) Fr., titubans (Bull.) Fr.
Cortinarius (Phlegmacium) praestans Cordier, causticus Fr.
(Myxacium) elatior Fr.
(Dermocybe) caninus Fr., anomalus Fr., cinnamomeus (Linn.) Fr., var. croceus Fr., semisanguineus Fr.
(Telamonia) armillatus Fr., hinnuleus (Sow.) Fr., brunneus (Pers.) Fr., glandicolor Fr., iliopodius (Bull.) Fr., hemitrichus (Pers.) Fr., paleaceus (Weinm.) Fr.
(Hydrocybe) saturninus Fr., castaneus (Bull.) Fr., uraceus Fr., leucopus (Pers.) Fr., decipiens (Pers.) Fr.
Gomphidius viscidus (Linn.) Fr.
Paxillus giganteus (Sow.) Fr., involutus (Batsch) Fr.
Hygrophorus (Limacium) hypothejus Fr.
(Camarophyllus) pratensis (Pers.) Fr. var. umbrinus W. G. Sm., Collemannianus Blox., virgineus (Wulf.) Fr., roseipes Mass., niveus (Scop.) Fr., russo-coriaceus B. & Br., ovinus (Bull.) Fr.
(Hygrocybe) sciophanus Fr., laetus (Pers.) Fr., citrinus Rea, vitellinus Fr., ceraceus (Wulf.) Fr., coccineus (Schaeff.) Fr., miniatus Fr., turundus Fr., Reai Maire, puniceus Fr., obrusseus Fr., conicus (Scop.) Fr., calyptraeformis Berk., chlorophanus Fr., psittacinus (Schaeff.) Fr., unguinosus Fr., nitratus (Pers.) Fr.
Lactarius (Piperites), turpis (Weinm.) Fr., pubescens Fr., blennius Fr., trivialis Fr., flexuosus Fr., fluens Boud., piperatus (Scop.) Fr., vellereus Fr.
(Dapetes) deliciosus (Linn.) Fr.
(Russulares) pallidus (Pers.) Fr., quietus Fr., vietus Fr.,

rufus (Scop.) Fr., glyciosmus Fr., fuliginosus Fr., volemus Fr., serifluus (DC.) Fr., mitissimus Fr., subdulcis (Bull.) Fr.

Russula (Compactae) nigricans (Bull.) Fr., densifolia Secr.
(Furcatae) sardonia Bres. var. emeticiformis, Clusii Bat. (=purpurea Gillet, atrorubens Quél and depallens Cke.), drimeia Cke (=expallens Gillet).
(Rigidae) xerampelina (Schaeff.) Fr.
(Heterophyllae) azurea Bres., cyanoxantha (Schaeff.) Fr., grisea (Pers.) Fr., consobrina Fr., var. sororia (Larbr.) Fr. var. minor (=pectinata Quél. non Fr.), foetens Pers., fellea Fr., subfoetens W. G. Smith.
(Fragiles) ochroleuca Pers., fragilis (Pers.) Fr., var. violacea Quél., var. fallax Cke., nitida (Pers.) Fr. var. pulchralis Britz., puellaris Fr.

Cantharellus cibarius Fr., amethysteus Quél., aurantiacus (Wulf.) Fr., umbonatus (Gmel.) Fr., infundibuliformis (Scop.) Fr., leucophaeus Nouel., muscigenus (Bull.) Fr.

Marasmius peronatus (Bolt.) Fr., oreades (Bolt.) Fr., plancus Fr., erythropus (Pers.) Fr., foetidus (Sow.) Fr., ramealis (Bull.) Fr., rotula (Scop.) Fr., androsaceus (Linn.) Fr., epiphyllus Fr.

Panus torulosus (Pers.) Fr.

Lenzites betulina (Linn.) Fr.

Boletus luteus Linn., elegans Schum., granulatus Linn., badius Linn., variegatus Swartz, chrysenteron Bull., pascuus Pers., subtomentosus Linn., spadiceus Schaeff., pruinatus Fr., edulis Bull., luridus Schaeff., erythropus Pers., scaber Bull.

Fistulina hepatica (Huds.) Fr.

Polyporus Schweinitzii Fr., squamosus (Huds.) Fr., picipes Fr., frondosus (Fl. Dan.) Fr., sulphureus (Bull.) Fr., epileucus Fr., hispidus (Bull.) Fr., betulinus (Bull.) Fr., adustus (Willd.) Fr., chioneus Fr., caesius (Schrad.) Fr.

Fomes annosus Fr., applanatus (Pers.) Wallr., igniarius (Linn.) Fr., connatus Fr.

Polystictus perennis (Linn.) Fr., albidus (Trog.) Fr., versicolor (Linn.) Fr., radiatus (Sow.) Fr.

Poria vaporaria Pers., mollusca (Pers.) Fr., vulgaris Fr., terrestris (DC.) Fr.

Daedalea quercina (Linn.) Pers., unicolor (Bull.) Fr.

Merulius corium (Pers.) Fr.

Hydnum repandum Linn., rufescens Pers., niveum Pers.

Irpex obliquus (Schrad.) Fr.

Phlebia merismoides Fr.

Grandinia granulosa (Pers.) Fr., mucida Fr.
Craterellus cornucopioides (Linn.) Pers., crispus (Sow.) Fr.
Thelephora laciniata Pers., terrestris Ehrh.
Soppittiella sebacea (Pers.) Mass.
Stereum gausapatum Fr. *On Oak*, hirsutum (Willd.) Pers., cristulatum Quél., purpureum Pers., sanguinolentum (A. & S.) Fr., rugosum Pers.
Coniophora puteana (Schum.) Fr.
Peniophora quercina (Pers.) Cke., gigantea (Fr.) Mass.
Corticium lacteum Fr., sanguineum Fr., comedens (Nees) Fr., atrovirens Fr.
Cyphella capula (Holmsk.) Fr., fulva B. & Br., Pimii Phil.
Exobasidium vaccinii Woronin.
Clavaria muscoides Linn., cinerea Bull., cristata Pers., rugosa Bull., Kunzei Fr., fusiformis Sow., dissipabilis Britz., luteo-alba Rea, persimilis Cotton, argillacea (Pers.) Fr., vermicularis Scop., fumosa Pers., acuta Sow.
Typhula erythropus (Pers.) Fr.
Pistillaria tenuipes (B. & Br.) Mass., quisquiliaris Fr., puberula Berk.
Auricularia mesenterica (Dicks.) Pers.
Exidia albida (Huds.) Bref.
Ulocolla foliacea (Pers.) Bref.
Tremella lutescens Pers., mesenterica Retz., sarcoides W. G. Smith.
Dacryomyces deliquescens (Bull.) Duby., stillatus Nees.
Calocera viscosa (Pers.) Fr., cornea (Batsch) Fr., stricta Fr., glossoides (Pers.) Fr. (=Dacryomitra glossoides (Pers.) Bref.).
Cyathus striatus (Huds.) Willd.
Crucibulum vulgare Tul.
Sphaerobolus stellatus Tode.
Lycoperdon pyriforme Schaeff., var. tessellatum Pers., var. excipuliforme Desm., perlatum Pers., umbrinum Pers., hyemale (Bull.) Vitt. (=depressum Bon.), caelatum Bull.
Bovista plumbea Pers.
Scleroderma vulgare Fl. Dan., verrucosum (Bull.) Pers.
Ithyphallus impudicus (Linn.) Fisch.
Mutinus caninus (Huds.) Fr.
Melampsoridium betulinum (Pers.) Kleb.
Coleosporium senecionis (Pers.) Lév., tussilaginis (Pers.) Lév.
Puccinia poarum Nielsen., hieracii (Schum.) Mart., lychnidearum Link.
Exoascus turgidus Sadeb.
Antennaria ericophila Link.
Nectria cinnabarina (Tode) Fr., coccinea (Pers.) Fr., episphaeria (Tode) Fr.
Hypomyces rosellus (A. & S.) Tul., aurantius (Pers.) Tul.

Hypocrea rufa (Pers.) Fr.
Cordyceps militaris (Linn.) Link.
Chaetomium elatum Kze.
Podospora minuta (Fckl.) Rehm.
Melanomma Pulvis pyrius (Pers.) Fckl.
Sphaerella rumicis Cke.
Quaternaria Persoonii Tul.
Valsa (Eutypa) lata (Pers.) Nitschke.
Diatrype stigma (Hoffm.) de Not.
Ustulina vulgaris Tul.
Xylaria hypoxylon (Linn.) Grev.
Daldinia concentrica (Bolt.).
Helvella crispa (Scop.) Fr., lacunosa Afzl.
Geoglossum ophioglossoides (Linn.) Sacc. (=glabrum Pers.), hirsutum Pers.
Mitrula olivacea (Pers.) Sacc.
Leotia gelatinosa Hill (=lubrica Pers.)
Rhizina inflata (Schaeff.) Karst.
Otidea leporina (Batsch) Fckl., cochleata (Linn.) Fckl., onotica (Pers.) Fckl.
Peziza aurantia Müll., linteicola Phil. & Plow., sterigmatizans Phil., badia Pers.
Humaria convexula (Pers.) Quél., granulata (Bull.) Quél.
Lachnea setosa (Nees) Phil., scutellata (Linn.) Gill., umbrorum (Fr.) Gill.
Dasyscypha acutipila (Karst.) Sacc., aspidiicola (B. & Br.) Sacc., fugiens (Phil.) Mass., calycina (Schum.) Fckl.
Helotium aureum Pers., cyathoideum (Bull.) Karst., scutula (Pers.) Karst. *On Pteris;* herbarum (Pers.) Fr., punctiforme (Grev.) Phil. *On dead Oak leaves.*
Belonidium pruinosum (Jerdon) Mass.
Mollisia cinerea (Batsch) Karst., juncina (Pers.) Rehm. *On Juncus.*
Ascophanus carneus (Pers.) Boud. *On Deer-dung, Chatsworth Park.*
Orbilia leucostigma Fr.
Coryne sarcoides (Jacq.) Tul.
Bulgaria polymorpha (Oeder.) Wetts.
Trochila ilicis (Chev.) Crouan.
Rhytisma acerinum (Pers.) Fr.
Spinellus fusiger (Link) van Tiegh.
Sporodinia aspergillus (Scop.) Schröt.
Cystopus candidus (Pers.) Lév.
Phytophthora infestans (Mont.) de Bary.
Peronospora parasitica (Pers.) Tul.
Cylindrium cylindrium (Cda.) Lindau, griseum Bon.
Botryosporium pulchrum Cda.

Trichoderma lignorum (Tode) Harz.
Penicillium glaucum Link.
Botrytis vulgaris Fr.
Acrostalagmus albus Preuss.
Clonostachys araucaria Cda.
Trichothecium roseum Link.
Periconia pycnospora Fres.
Helminthosporium rhopaloides Fres. *On dead Nettle stems.*
Stilbum tomentosum Schr.
Tilachlidium subulatum A. L. Sm.
Phlyctaena Pseudophoma Sacc. New to Britain.
Sphaeronemella fimicola Marchal.
Marssonia Delastrei (De Lacr.) Sacc.

*Mycetozoa.**

Ceratiomyxa mucida Schroet. *Yeld Wood*, Baslow; *Sheriff's Wood*, near Grindleford; fairly common.
Badhamia utricularis Berk. Perfect fruit, also plasmodium running on wood in Estate timber-yard at *Chatsworth.*
Badhamia panicea Rost. On timber in *Manner's Wood*, Bakewell.
Physarum viride Pers. *Yeld Wood*, Baslow; *Manner's Wood*, Bakewell.
P. nutans Pers. Very abundant in all the woods.
P. Diderma Rost. On decaying leaves of a *Carex*, near *Yeld Wood*, Baslow.
P. contextum Pers. Two gatherings in *Manner's Wood*, Bakewell.
Fuligo muscorum A. & S. Two gatherings in *Highlow Wood*, near Grindleford.
F. septica Gmel. Common in nearly all the woods.
Craterium leucocephalum Ditm. On holly leaves, &c., *Yeld Wood*, Baslow.
Leocarpus vernicocus Link. *Yeld Wood*, Baslow; *Manner's, Wood*, Bakewell.
Chondrioderma reticulatum Rost. *Chatsworth Park.*
Chondrioderma floriforme Rost. *Chatsworth Park.*
Didymium difforme Duby. Wood-yard near *Grindleford.*
D. Clavus Rost. On holly leaves, *Yeld Wood*, Baslow.
D. nigripes Fr. *Chatsworth Park; Sheriff's Wood*, Grindleford.
var. xanthopus Fr. On decaying bracken in *Sheriff's Wood.*
D. effusum Link. *Yeld Wood, Chatsworth Park*, &c.

* These were kindly determined by our Members, Miss Gulielma Lister, F.L.S., and W. B. Allen.

Spumaria alba D.C. *Manner's Wood*, near Bakewell.

Lepidoderma tigrinum Rost. On moss, &c., in *Sheriff's Wood*, near Grindleford.

Stemonitis fusca Roth. On beam of an old sawpit, Estate timber yard at *Chatsworth.*

S. flavogenita Jahn. *Sheriff's Wood* near Grindleford and *Manner's Wood* near Bakewell.

Comatricha Persoonii Rost. On leaves in *Manner's Wood*, Bakewell.

Lamproderma irideum Mass. On leaves, *Yeld Wood*, Baslow.

L. echinulatum Rost. A fine gathering on birch log in *Sheriff's Wood*, near Grindleford. This is a rare species, probably fourth British record.

Cribraria argillacea Pers. Very abundant on old timber in a wood-yard at *Grindleford*, and in Estate timber yard at *Chatsworth.*

C. aurantiaca Schrad. On timber in a wood-yard at *Grindleford.*

C. rufescens Pers. On moss on very wet rocks in *Sheriff's Wood*, near Grindleford.

Tubulina fragiformis Pers. Well distributed, *Baslow*, *Bakewell*, *Chatsworth* and *Grindleford.*

Enteridium olivaceum Ehrenb. *Baslow*, *Chatsworth* and *Grindleford.*

Reticularia lycoperdon Bull. On a log in *The Hydro. grounds at Baslow.*

Trichia affinis de Bary. *Yeld Wood*, Baslow and *Chatsworth Park.*

Trichia persimilis Karst. *Chatsworth Park.*

T. varia Pers. *Yeld Wood*, Baslow; *Manner's Wood*, Bakewell; *Chatsworth Park;* not at all abundant.

T. botrytis Pers. var. munda List. A beautiful gathering on old wood in timber yard at *Chatsworth.*

Arcyria albida Pers. *Chatsworth Park.*

A. punicea Pers. Well distributed in nearly all the woods.

A. flava Pers. On stump near *Yeld Wood*, Baslow.

Perichaena populina Fries. Both purple and grey forms. On wood in timber yard at *Chatsworth.*

Lycogala miniatum Pers. *Sheriff's Wood* and wood yard near *Grindleford.*

PRESIDENTIAL ADDRESS.

By Professor M. C. Potter, Sc.D., M.A., F.L.S.

BACTERIA IN THEIR RELATION TO PLANT PATHOLOGY.

I have chosen the subject of my address with some misgiving and hope to disarm criticism by an instant confession of wrong-doing. I fear that a consideration of Bacteria in their relation to Plant Pathology will hardly be regarded as a legitimate subject of discussion, by the Mycological Society. I may claim, however, this justification: that it is a question much neglected among English Botanists; the ordinary text-books on Bacteria, while dealing fully with the well-known forms pathogenic to animals, make only brief and imperfect mention of those pathogenic to plants, and a brief survey of our present knowledge of this important branch of phytopathology may not be without its use.

When we reflect upon the enormous advances which have been made in recent years in the ætiology of plant-diseases, upon the far-reaching results of pathological researches, which have been pursued hand in hand with modern methods of experiment in associated problems of physiology, it is suprising that little more than 40 years carry us back to the beginnings of this department of science. Somewhere about the year 1860 the older systematists began to be succeeded by mycologists eager to investigate the plant as a living organism. Much splendid work was done at this time by the Tulasnes and other observers in working out the life-histories of various types of Fungi, and invaluable material was left as a heritage upon which to build in the future. In 1865 de Bary published his observations showing the actual entrance of the germ-tube of a parasitic fungus into its host, and his epoch-making researches may truly be said to have laid the foundation of our present knowledge of both plant and animal pathology.

Cohn was one of the earliest workers in the domain of Bacteriology, and he must certainly be regarded as the real founder of this branch of mycology. Koch owed much to his training under Cohn; the latter had already in part worked out the life-history of the *Bacillus anthracis*, and his joy was great when Koch triumphantly demonstrated to him in the Botanical

Laboratory at Breslau the complete pathological development of this parasite. The result of his researches, embodying the first proof that a specific disease of the higher animals owed its origin to a bacillus, was published by Koch in the "Beiträge zur Biologie der Pflanzen" in 1876. In 1878 came Burril's paper on Pear Blight, followed in 1879 by Prillieux's description of the Pink discolouration of Wheat due to a *Micrococcus;* these being the very first accounts of any disease of plants attributed to Bacteria.

Burril traced the disease known as "Pear Blight" or "Fire Blight," producing a blackening of the parts affected and a gummy exudation, to the attack of a micro-organism, *Micrococcus amylovorus.* There was no trace whatever of fungoid growth in the diseased tissues until after the death of the cells. He succeeded in communicating the disease by a series of inoculations by direct infection from the diseased to the healthy tissues, and these results were subsequently confirmed by the more definite cultural experiments of Arthur (1885). It was not, however, until ten years later that Waite fully substantiated the origin of the disease by isolation of the Bacterium and successful infection with pure cultures.

Prillieux made a very close observation of the microscopic features of the disease of the Wheat, which was invariably associated with the presence of *Micrococcus tritici.* He noted their destructive action upon the elements constituting the grain, the corrosion first of the starch-grains, then the proteids, and also the dissolution of the cellulose, but he made no cultures or attempts at inoculation. In the same year (1879) van Tieghem carried out some important investigations for that day upon the action of bacteria as agents in the destruction of cellulose, and claimed that his experiments proved the destruction of the cell-walls in living plants and tubers to be due specially to the influence of *B. Amylobacter.* It is now recognized that he was working with impure cultures. His main contention, however, still holds good, and more recent researches have fully demonstrated the existence of definite bacteria which exercise a fermentative action upon the cell-wall. Wakker's extended investigations (1883-1889) into the nature of the "Yellow-stripe" of Hyacinths led the way in the study of an interesting type of bacterial parasitism, involving a destruction of the tissues which advances along the vascular bundles. A feature of this disease is a blocking of the xylem vessels by a yellow, gummy substance, followed by the dissolution of the cellulose walls. Frequent inoculations always produced a recurrence of the same symptomatic characters in healthy plants; but these were the result of direct infection experiments without the intervention of culture media.

Unfortunately much of this early work rested upon evidence which could not be regarded as conclusive, owing to imperfect methods of experiment and the absence of proper precautions to ensure pure cultures. A knowledge of good cultural conditions, however, was not wanting even at this date, though it was not generally applied. Klebs and Brefeld's gelatine-methods of preparing culture media were already in operation; and the introduction, in 1881, of Koch's methods of isolation by means of plate-cultures simplified the preparation of pure cultures and afforded further facilities for bacteriological research. Koch's dicta, in 1883, established the recognized procedure necessary for the definite determination of a disease due to a specific organism: viz. (1) it is essential that the organism be present in the diseased tissues; (2) that it be grown artificially in suitable media for several successive generations; (3) that inoculations from the pure cultures so obtained should produce the same manifestations of the disease in healthy tissues, and (4) the same organism must be again isolated from the artificially infected tissues.

In view of such advances and after the impetus given to Animal Pathology by the researches of Koch and Pasteur, it appears strange that more attention was not devoted to the part played by Bacteria pathogenic to plants. Very few workers were attracted to this field of research, the whole principle of bacterial plant-diseases met with doubt and opposition, and even later, when careful investigation and exact study of the life history left nothing to be desired, great reluctance was still shown to admit the truth of these conclusions. In 1882 Dr. R. Hartig stated his conviction that there was no such thing as diseases of plants due to Bacteria. In 1884 de Bary asserts that they have scarcely ever been observed, and again in 1885 in the "Lectures on Bacteria" he assumes that present knowledge justifies him in regarding "parasitic bacteria as of but little importance as the contagia of plant-diseases." The whole subject is dismissed in some two pages with the mention of Wakker's Hyacinth, Burril's Pear and Apple Blight, Prillieux's Wheat disease, and Whemer's Wet Rot of Potatoes; and while admitting that saprophytic bacteria may, under special conditions, attack the tissues of living plants as facultative parasites, he concludes by a repetition of the statement that Bacteria are not objects of great importance in diseases affecting plants.

Hartig considered the plant-organism protected from bacterial intrusion, owing to its peculiar structure and the absence of circulatory channels which would serve for the distribution of micro-organisms, and that serious obstacles to their passage were presented by the impervious character of the non-nitrogenous cell-walls. Further, that the acid reaction of the cell-sap

operates unfavourably for their growth. This latter view was also shared by de Bary. The reasons advanced by Hartig are merely theoretical, and when submitted to actual experiment have been shown to break down. The citation of recent work upon the secretion of a cytase by bacteria and their penetration through the softened cell-wall, that showing the entrance of the bacteria through the water-pores and their power of living and travelling in the xylem vessels, is sufficient to indicate how completely his conception was at fault. Though the influence of the acidity of the cell-sap has an important bearing upon the tendency to disease, it is now well known that the nature of the cell-sap offers no absolute resistance to the active growth of bacteria. It has been proved that the reaction of the parenchymatous tissues is by no means always acid, and moreover certain bacteria have been found to flourish best in distinctly acid media; while others possess the property of producing alkaline secretions which assist their penetration into the cells.

It is possible that the authority of such names as those of de Bary and Hartig may have had a deterrent effect upon the study of this branch of plant pathology. Nevertheless, a mass of literature gradually accumulated in favour of bacterial parasitism. In 1896 E. F. Smith published, in the American Naturalist, "A Critical Review of the present state of our knowledge upon the Bacterial Diseases of Plants." He drew attention to the unsatisfactory nature of much of the work in this field, and the need for full descriptions of the various forms, including a study of both morphological and biological peculiarities. At the same time he emphasized the importance of the strictest cultural technicalities and rigid tests of pathogenesis, which have too often been disregarded. His review of thoroughly investigated examples up to that date leaves no doubt that certain well-marked plant diseases owe their origin solely to a specific parasitic bacterium.

The accepted evidence up to 1897 rested upon much carefully conducted work, based upon Koch's four premises, in which the organism had been studied in pure culture, and repeated inoculations from pure cultures produced always the characteristic pathogenic symptoms and the reappearance in the tissues of the plant of the same specific organism. The diseases thus conclusively established may be briefly summarized:—

Pear-blight—*Bacillus amylovorus.*	Burril	1880.
	Arthur	1884.
	Waite	1895.
Yellow Disease of Hyacinth—*Pseudomonas hyacinthi.*	Wakker	1883-1889.

Canker of the Olive—*Bacillus oleæ.*	Archangeli	1886.
	Savastano	1886.
	Prillieux	1890.
Corn-blight—*Bacillus zeæ.*	Burril	1889.
Potato Wet-rot—*Bacillus solaniperda.*	Kramer	1890-1891.
Soft Rot of Hyacinth—*Bacillus hyacinthi-septicus.*	Heinz	1889.
	Smith	1897.
Bacteriosis of the Vine—*Bacillus uvæ.*	Macchiati	1894.
Cucurbit Wilt—*B. tracheiphilus.*	Smith	1895.
Brown Rot of Cruciferæ—*Pseudomonas campestris.*	Smith	1896.
Potato and Tomato Disease—*Bacillus solanacearum.*	Smith	1896.

Migula, in his System der Bakterien, May, 1897, although still considering that the impenetrable cell-wall of plants presents great difficulties to the entrance of bacteria and that stomatal infection is generally impossible, yet allows that these objections do not universally hold. He admits that a number of bacterial diseases have been established, and devotes considerable space to the discussion of many well-known cases. Migula's attitude upon this question is in great contrast to that of Dr. Alfred Fischer at the same date. In the "Vorlesungen über Bakterien" (July, 1897) Fischer, in spite of the evidence available, expressed complete disbelief in the existence of bacterial diseases of plants. With the exception of the root-nodules of Leguminosæ, he professed to know of no single instance where bacteria invade the closed, living cells of plants, and states that the uninjured plant is "quite impregnable to their attacks." He maintained that bacteria live metatrophically only in diseased plant tissues "that have already been disintegrated and decayed by parasitic fungi." That the bacteria may "assist these subsequently in their work of destruction and modify perhaps more or less the character of the disease, but except for injuries from frost or insects the first attack on the plant is always made by fungi. All the cases of so-called bacteriosis of plants from the 'gommosæ bacilliare' of the Vine down to the 'schorf' of the potato, are primarily diseases of non-bacterial origin in which the bacteria are present merely as accidental invaders." He even goes so far as to state that "infected wounds are dangers that have no existence for plants," owing to the development of wound-cork which would cut off the provision of moisture and supplies of nutriment to the exclusion of the further progress of any pathogenic bacteria. As will be seen later, the rapid destruction of the cells, due to the activity of a bacterial parasite, as a rule precludes

this protective tissue being formed; and the idea that fungi are always responsible for the primary attack is not in accordance with the cases described in which no trace of a fungal hypha was present. It is not possible here to enter in detail into a discussion of the points at issue, but Fischer's whole conception of the case showed such ludicrous ignoring of demonstrated facts in bacteriological research and such retrograde notions of the general physiological aspects of microbial infection, that some refutation was necessary. E. F. Smith, to whose investigations in this branch of plant-pathology we owe so much, took up the challenge and had no difficulty in showing the completely erroneous nature of Fischer's statements and "unwarranted assumptions." Smith has proved that in the case of the "Black-rot of the Cabbage" fully 90 per cent. of the infections take place through the water-pores, which provide in the epithem-tissue all the elements in solution necessary for the growth of bacteria. This ready entrance effected by *P. campestris* through the water pores has also been confirmed by H. L. Russell. As shown by Gardiner the water glands are continuous with the termination of a fibrovascular bundle, which thus furnishes a readily accessible channel for the progress of the attack. Stomatal infection has also been observed by Smith in a disease of Japanese plums, caused by *Pseudomonas pruni*. Waite proved by his experiments on Pear Blight that a large proportion of the infections take place naturally by means of the floral nectaries. The stigma is another part of the plant which presents an unprotected mode of access, and Kissling's work on the biology of *Botrytis cinerea* supplies an instance of very facile infection of the gentian through the anthers and stigmatic surfaces.

It would have been unnecessary to allude to Fischer's theories and mis-statements, were it not for the fact that in the English translation of his Lectures, issued by the Clarendon Press in 1900, the same errors are reiterated. This is all the more striking as this translation was published under the author's sanction and enjoyed the advantage of a proof-revision by Marshall Ward. Ward in general held the view that Bacteria in association with plant diseases were but a secondary accompaniment of the malady, and in his treatise upon "Disease in Plants" this author makes no allusion to the destruction of cellulose by bacteria, which plays such an important rôle in the penetration of the cells and the rapid disintegration of living vegetable tissues.

As early as 1850 Mitscherlich announced to the Academy of Berlin his discovery of the fermentation of cellulose, which he demonstrated by experiments upon the cells of the potato. His material contained no trace of any fungus, and he suggested that the "vibriones" which were present in great abundance must be

the agents responsible for the phenomenon. In 1865, Trecul, in the course of his researches upon laticiferous vessels, observed the appearance of minute bodies in the tissues under examination which seemed to him to arise quite suddenly and spontaneously in the laticiferous vessels and closed cells. These bodies, which he termed *Amylobacter*, furnished him with an argument in favour of spontaneous generation, only disposed of when, later, van Tieghem showed them to be stages in the development of a Bacillus, named by him *B. Amylobacter*, and identical with the "vibriones" which Mitscherlich had rightly supposed to be the active agents in the dissolution of cellulose. van Tieghem clearly showed that certain Bacteria possess the remarkable property of dissolving cellulose, but he was undoubtedly working with mixed cultures and was mistaken in attributing his results specifically to *B. Amylobacter*. Prillieux's observations upon the breaking down of the cell-walls under the action of *B. tritici* have already been mentioned. Van Senus, in 1890, attributed the fermentation of cellulose to a cellulose-dissolving enzyme produced by the symbiotic action of two bacteria, one aerobic and the other anaerobic. Later, Omeliansky (1895) isolated, from the mud of the river Neva, an anaerobic bacillus which entirely dissolved filter paper with the greatest rapidity. These investigations, however, dealt with organisms acting saprophytically. The question of the destruction of the cell-wall of living plants by the action of parasitic bacteria was first definitely established by the researches, published simultaneously, of Laurent and myself (1899).

Laurent, in his investigations upon the potato and the causes of its greater or less resistance to bacterial disease, established the existence of a cytase, which dissolved the middle lamella, rapidly softened the cell-tissues, and caused the disaggregation of the cells. The organism which was the chief subject of Laurent's researches, *B. coli communis*, is very rarely capable of living as a parasite upon potato tubers and other plants. It was necessary for the tubers to be deprived of resistance, by means of exceptional cultures, to enable the bacillus to develop upon the potato. From that point its virulence was increased by successive cultivations upon tubers of slight resistance, until varieties at first highly resistant ended by becoming invaded by the parasite. The virulence disappeared as soon as the microbe ceased to be cultivated on a living tuber, cultures in nutritive solutions served to suppress the aptitude of the parasite, and henceforward it could only be restored after special preparation in alkaline solutions. In this he demonstrated a complete parallel with Kissling's researches on *Botrytis*.

The bacterium, causing the "white-rot" of turnips, which was the subject of my special research, belongs to the genus

Pseudomonas and illustrates a very virulent form of parasite. It was isolated from turnips attacked in the fields and, unlike *B. coli communis*, flourished on nutritive media, and even after many cultivations could readily be inoculated from these on to pieces of living turnip, producing all the effects of the white rot in about 12 hours. This organism was grown in pure culture from a single bacterium and, both when living in a nutrient solution and on a living turnip, was found to secrete an enzyme which has the power of dissolving the middle lamella and of causing the softening and swelling of the cell-wall. I also demonstrated the production of oxalic acid by the bacterium, and that this acid acts as a toxin in plasmolysing and killing the protoplasm. This proof of the secretion of a cellulose-dissolving enzyme introduced a new factor, and finally disposed of the "impassable barrier" supposed to be offered by the cellulose membrane to the entrance of bacteria. As the result of further researches I was able to trace, by continuous observation, the actual penetration of the bacterium through the cell-wall. The observation of the movements of the bacteria, though difficult and very trying, was yet considerably furthered by the difference of refractive index between the cell-wall and the bacteria, which enabled the course of the latter to be distinctly followed.

It is not until the protoplasm has been killed by the toxin and the cell-wall very much softened by the cytase that the bacteria have the power of perforating the walls and passing into the cell-cavity. It would hardly be supposed that a single bacterium, through its own exertions, could soften the cell-wall and pierce it at one definite point after the manner of a fungus germ-tube. The extreme minuteness of the bacteria and the rapidity of their multiplication lead them to act, as it were, in concert, and the wall becomes softened by the cumulative action of many bacteria before the penetration of a single individual.

The old and fully developed cuticle is apparently proof against the action of the enzymes excreted by *P. destructans*, but this parasite can readily effect an entrance into its host through the undeveloped epidermis of young and tender structures. It is incapable of manipulating the hard and tough rind of the sound turnip, but when brought into contact with a wounded surface it at once flourishes as a saprophyte upon the remains of the injured cells; very soon the number of bacteria becomes largely increased, and the toxin and cytase have sufficiently accumulated to kill the first cell. With the death of its protoplasm the cell-contents are liberated, and an additional supply of nutriment is thus provided; the bacteria continue to multiply, cytase and toxin continue to be set free, and thus each cell succumbs in turn.

A comparison of the parasitism of *Botrytis cinerea*, as demon-

strated by the investigations of Nordhausen, presents an exact parallel. He has shown that the spore of this fungus excretes a powerful toxin in its initial stages of germination, before any trace of the germ-tube can be detected. Its manner of effecting an entrance into a host-plant is first to kill the cell by the emission of the toxin; the germ tube then penetrates the dead cell and is nourished saprophytically upon it; with the vigour thus gained it destroys the neighbouring cells and passes from one to another without difficulty. The fungus hypha has the power of perforating the cuticle, but only in young and tender structures; old and hardened membranes could only be entered when the cuticle had been injured, or when it had gained strength by special saprophytic nutrition. Thus the bacilli play here a part absolutely comparable to that of the fungi and a complete homology is established between them.

This form of parasitism is apparently typical of a large class of bacterial diseases, in which there is a rapid degeneration of the cell-wall and complete destruction of the parenchymatous tissues. Van Hall's researches in 1902 demonstrated the action of a toxin secreted by *Bacillus omnivorus* when attacking *Iris florentina*, and four years later (1906) Harrison isolated a cytase in the case of a disease of cauliflowers caused by *B. oleraceæ*, which exhibited symptoms identical with those produced by *Pseudomonas destructans*. A cytase is also concerned in the rot of the Carrot and other allied plants, described by Jones (1905); and probably in certain potato rots, though in these last instances the enzyme has not been isolated. Another species of *Pseudomonas* producing a brown rot of the Turnip, which I have had under investigation, belongs to a group working in a totally different manner; the action is very much slower, and the rapid swelling of the cell-wall is not a conspicuous feature. The tumourous diseases, such as the canker-knots of the Olive, caused by *Bacillus oleæ*, also exhibit a comparatively slow development.

Another type of bacterial disease is that in which the xylem vessels are primarily attacked and become filled with numerous bacteria. As a consequence the transpiration current is unable to flow along these channels, the supply of water is cut off, and hence a withering of the shoots occurs. In the bacterial disease of Sweet-corn, described by F. C. Stewart, the organism is confined exclusively to the fibro-vascular bundles and never pervades the cells of the parenchyma. In many other cases there is subsequent invasion of the parenchymatous tissues, and total destruction of the cell and cell-contents ensues. Examples of this type are found in the wilting of various Cucurbitaceæ traced to *B. tracheiphilus;* the bacterial disease of the Tomato, Egg-plant, and Irish Potato; the Yellow-rot of Hyacinths; the

Bacteriosis of *Dactylis glomerata*, etc. In this category must also be included the Brown or Black rot so prevalent in species of the genus *Brassica* and other Cruciferæ. A striking symptom of this disease is the blocking of the lumen of the wood-vessels and also the neighbouring intercellular spaces with a kind of gum or mucilage. This gum is most insoluble. It stains red with phloroglucin and reacts to thallin sulphate, but remains uncoloured under the phenol-potassium-chlorate hydrochloric acid test, thus bringing it within the vanillin group. It is a substance probably derived from the soluble carbohydrates. There are many "gum-diseases," such as the Gummosis of the Beet-root, Sugar-cane, and Vine, and the gummy flux of the Amygdaleæ, which have now been traced to the activity of certain definite Bacteria.

It is impossible to do more than briefly indicate the characteristic features of attack in a few cases; it will be understood that numerous other examples have been worked out which have been obliged to be left quite unrecorded.

In addition to their rôle of parasites, the Bacteria function very actively as saprophytes, following in the wake of parasitic fungi and completing their work of destruction, and this observation has no doubt led to the scepticism as to their aptitude as true parasites. Thus Ward (1898) states: "Without going so far as to say there is no bacterial disease of the potato, I wish to express the conviction that the alleged cases of such lately published are not convincing, and that a tendency exists to draw conclusions from imperfect evidence. I shall show that the way into the tuber is prepared for bacteria by fungus hyphæ and the open passages of destroyed vascular bundles affords them ample space." No one would seriously think of contesting this last statement; that bacteria should be present in many fungoid plant diseases is but natural to expect, and that their part is only secondary may be true in certain cases, but undoubtedly the converse is also true, that is, that the bacteria are often the prime agents in paving the way for the fungus hyphæ. In cases where bacteria and a fungus are associated together in a plant disease, it is necessary to isolate these organisms and grow them in pure culture. As regards the bacteria, modern methods of culture have rendered this a fairly easy task, but to obtain the fungus free from any bacteria is a matter of the utmost difficulty. The definition of a pure culture in the case of fungi must be extended. It can no longer mean that no other fungus is present, but must include the conception that bacteria are also entirely absent.

A promising field of enquiry awaits the investigator into the relation between bacteria and fungoid parasites, and their association one with another in plant pathology. In the disease

known as "Finger and Toe," bacteria are always present in conjunction with *Plasmodiophora*, and hitherto, I believe, a culture of *Plasmodiophora* free from bacteria is unknown. Pinoy considers that they play an active part in this disease. The parasitism of *Fusarium* affords a further illustration. A species of *Fusarium* commonly met with on Turnips and Swedes in Northumberland, is apparently responsible for a large number of diseased roots in the fields. But in the decaying roots bacteria in abundance are invariably associated with the hyphæ, and so far, considerable difficulty has been experienced in obtaining a culture of this fungus entirely free from the bacteria. Until this has been accomplished the question of its parasitic nature cannot be decided in this case. Wehmer and Frank claim to have grown *Fusarium solani*, from a pure culture, as a parasite upon the potato; but these and other published accounts still leave a doubt as to the absolute exclusion of bacteria throughout the entire experiments. Under natural conditions of infection at least, it remains an open question whether the bacteria or the *Fusarium* is the secondary factor or whether the destruction of the host-cells is due to their combined influence. In the Erysiphaceæ again one would certainly expect innumerable bacteria to be present on the leaves together with the fungal hyphæ, but nothing is known as to their action, and apparently these organisms have been entirely left out of consideration here, as in many other fungoid parasites.

The epiphyllous lichen flora is a striking feature of the tropical rain forests, and one is naturally led to search for its analogue in temperate climates. Burri (1903) has shown that an actively living bacterial flora is ordinarily to be found on leaves, and that these bacteria form a special class quite distinct from those normally present in the air or soil. The number of bacteria actively existent upon the surface of leaves may be several millions per gram. of leaf, while the number of those in the resting condition (presumably accidentally deposited) is always relatively very few. No relationship could be established between the number of bacteria and the atmospheric conditions. Düggeli has also shown that certain bacteria accompany dry seeds or fruits, and on germination find their way upon the leaf-surface.

In addition to the well-known epiphyllous fungus *Apiosporium (Fumago)*, I have found that other fungoid and bacterial germs are extensively present upon the surface of healthy leaves under the ordinary conditions. This was strikingly exemplified by impression cultures of leaves made upon the surface of a nutrient gelatine, in petri capsules. While still attached to the plant the leaves were lightly pressed upon the gelatine in the capsule, which was only momentarily opened for this purpose, and an

impression of the leaf surface was thus obtained. In every case incubation after 2-3 days showed numerous colonies of bacteria; and fungi, chiefly represented by species of *Penicillium* and *Botrytis*, were also met with. The colonies were confined to the area of the leaf impression, which was distinctly outlined in this way, and no growths appeared on the surrounding medium (Plate 10). The organisms were equally abundant on both upper and lower surfaces of the leaf, and the species apparently vary with the season and the kind of leaf.

Since this epiphyllous flora is always present upon the surface of green plants, it becomes a matter of considerable interest to determine the part played by these micro-organisms in the ordinary fungoid diseases. Are these bacteria at all concerned in the problem of immunity? Do they in any way modify the life-histories of other bacteria or fungi with which they come in contact? I would merely throw out a suggestion that without being in any way harmful germs, they may yet profoundly influence existing conditions in some unsuspected way.

The question whether non-pathogenic micro-organisms are normally present in plant tissues and can maintain their existence in the intercellular spaces is another interesting speculation. It must be remembered that for the purposes of respiration, etc., the intercellular system of plants is in constant communication with the surrounding atmosphere, and thus an easy entrance is afforded through the stomata or lenticels. Whether having gained an entrance the bacteria can actively live, or persist as spores, in the intercellular spaces requires further elucidation. In 1887 Gallipe's experiments led him to the conclusion that the soil micro-organisms enter the roots or tubers of many plants, and in 1888 Bernheim announced that micro-organisms are to be found in the Indian corn and other cereal grains. These conclusions have been very adversely criticized, and neither Buchner, Lehmann, nor Fernbach and Di Vestea have been able to confirm these results. Lominsky, however, finds that the soil bacteria can pass into the root tissues; and Fernbach and Di Vestea, though considering the interior of healthy, uninjured tissues to be free from bacteria, yet grant the fact of their presence in the interior of cut plants exposed to a damp atmosphere.

The method employed by the investigators mentioned was generally to sterilize the surface of the plant tissue in the bunsen flame, to remove a small portion of the uncharred tissue beneath with a hot scalpel, and immediately place it in a sterile nutrient medium. Following up this method I selected various roots or tubers taken straight from the ground, such as Potatoes, Swedes, Turnips, Carrots and Beetroots. These were cut with a heated knife, the cut surface thoroughly charred upon an iron plate

placed over a bunsen flame, and small pieces from the interior removed with a heated scalpel and placed in sterile plugged test-tubes. Only in some cases were Bacteria found to develop. When, however, the roots or tubers were first kept in the laboratory for 3 days in a damp atmosphere and then treated in precisely the same manner Bacteria were always found to be present in the tissues. As far as the evidence goes it appears to indicate a possibility that the intercellular spaces of storage organs in the natural state may harbour living bacteria, but that they would almost certainly be present in detached portions of plants subjected to a damp atmosphere or other abnormal conditions.

Pasteur has determined that bacteria are not present in the normal healthy animal tissues. This view is also generally held with regard to vegetable tissues, but some more conclusive experiments are needed to decide this point in the case of plants.

In many physiological experiments connected with plants, the existence of bacteria, both on the external surface and possibly in the intercellular spaces, is ignored, but the action of the various micro-organisms present must have contributed in some measure to the effects recorded. That a neglect of such considerations may lead to serious misconception is exemplified by the observations of Stoklasa. The generally accepted view that an injured plant organism breathes more actively than an uninjured one is shown by him to be incorrect. The experiments by Stich were not conducted under conditions free from bacteria, and when repeated by Stoklasa under sterile conditions were found to give opposite results. Under proper precautions the respiratory activity of injured cells proved to be less than that of uninjured tissue, and the increased production of CO_2 at a wound was traced to the activity of the Bacteria living upon the injured cells.

The external conditions to which any plant is exposed have an important bearing upon its general health, and render it more resistent or more susceptible to parasitic attack. *Phytophthora infestans* may be cited as a familiar instance. It is generally recognized that light, and the temperature and vapour pressure of the air, influence in a marked degree the destructive action of this fungus and presumably also of other fungoid and bacterial parasites. Again the temperature, air and moisture-content of the soil, and the nature of its food constituents, are all forces necessarily affecting the general vigour of any host-plant. There is considerable evidence that susceptibility to disease is influenced by manurial treatment and that abundant fertilization, especially with nitrogenous manures, renders the host less resistant to microbial invasion. Laurent has shown how the susceptibility of a given variety of potato was related to the manurial treatment under which it was cultivated. Thus the

variety Simpson, when grown in a soil manured with phosphorus, maintained a high degree of resistance to certain bacteria, which was totally lost when grown on the same soil liberally manured with lime. This he attributed to the action of the lime in liberating ammonia.

The direct relation of the character of the cell-sap to the question of immunity is also a well ascertained fact, though Laurent proved that the *total* acidity bore no relation to the degree of resistance. Experiments showed that the resistance of tubers of potato to bacterial invasion was due to soluble substances which exist in the cell-sap, and that the immunity could be destroyed by subjection to alkaline solutions. The effect which a difference in chemical composition of the plant-tissues can exercise upon the development of a virulent form of parasitism is strikingly exemplified by Laurent's experiments with different forms of *B. coli communis*, *B. fluorescens*, *B. enteridis*, *B. typhique*, etc. All of these species were found capable of living as true parasites on the potato after special treatment had first diminished the resistance of the cells, the typhus bacillus showing the most surprising results in power of virulence.

May we not consider that the different forms of *Botrytis* raised by Kissling, as also the different forms of *B. coli communis* of Laurent, are "biologic forms" and that the foundation of this theory was laid by Kissling in his work upon *Botrytis*.

The past few years have been remarkable in considerably extending our knowledge of parasitic diseases and in opening out new avenues of research. The parasitism of bacteria has been established equally with that of the fungi and much confusion has been cleared away. But the mutual relationship of these parasites in certain plant diseases still demands attention, and their action upon the living cell requires much further elucidation. With a knowledge of the fact that nutrition may so alter a facultative saprophyte that it becomes a virulent parasite, while through other nutritional changes its virulence may be entirely lost, and further that the same influence operates in rendering the host more or less susceptible, we have the key to one of the important determining factors in the epidemic diseases of plants. It is no longer sufficient to trace life-histories or to prove parasitism under certain special conditions. The nutrition of both host and parasite must be taken into account, together with other factors which tend to disturb the nice balance existing between conditions of health and disease. We must look to the application of the laws of physical chemistry, in the botanical laboratory and in the field, for a solution of these and other problems connected with Plant Pathology.

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„ - - The life history and characters of the Pear-blight germ. *American Journal of Agricultural Science. 1891.*

Wakker - - Vorläufige Mittheilungen über Hyacinthenkrankheiten. *Botanisches Centralblatt. Bd. xiv. 1883.*

Ward, H. Marshall A potato disease. *Annals of Botany, vol. xii., 1898.*

„ „ Disease in Plants. *1901.*

Wehmer - - Ueber die Ursache der sogenannten "Trockenfäule" der Kartoffelknollen. *Berichte der deutschen botanischen Gesellschaft. Bd. xiv. 1896.*

„ - - Die Bacterienfäule (Nassfäule) der Kartoffelknollen. *Berichte der deutschen botanischen Gesellschaft. Bd. xvi. 1898.*

Van Hall - - Bijdragen tot de kennis der Bakterieele Plantenziekten. *Amsterdam. 1902.*

„ - - Das Faulen der jungen Schösslinge und Rhizome von Iris florentina und I. germanica. *Zeitschrift für Pflanzenkrankheiten. Bd. xiii. 1902.*

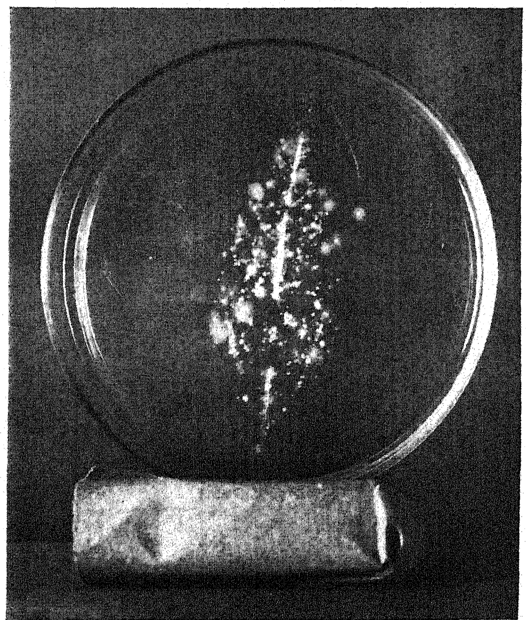
Van Senus - Beiträge zur Kenntniss der cellulose gärung. *Leiden. 1890.*

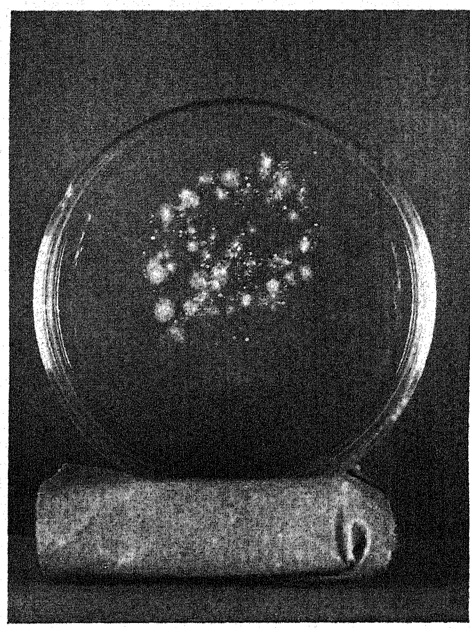
van Tieghem - Sur la fermentation de la Cellulose. *Bulletin de la Société Botanique de France. T. 26. 1879.*

Description of Plate 10.

Impression cultures of leaves upon nutrient gelatine, incubated for three days (Sep. 4-7), showing the colonies developed. A, upper surface of the leaf of an artichoke *(Helianthus tuberosus);* B, under surface of the leaflet of a potato *(Solanum tuberosum).*

A.





B.

West, Newman proc.

SOME NEW AND INTERESTING BRITISH HYMENOMYCETES GATHERED AT THE BASLOW FUNGUS FORAY, 1909.

By René Maire, D.Sc., &c.

WITH PLATE XI.

1. *Clitocybe ericetorum* (Bull. Champ. France, t. 551, f. I. E. & F. ? Fries Epicr., p. 73, *sub Agarico*) Quél., Champ. Jura et Vosges, in Mém. Soc. Em. Montbéliard, 1872, p. 89; Bres. Fung. Trid. II., p. 9, t. 113.

This species grew abundantly in Richmond Park, Surrey, it is of small size and is easily known by its *bitter taste and pleasant smell*, which is exactly *like that of Cortinarius purpurascens*. The bitter taste is mentioned only by *Bresadola*, who gives an excellent description and figure of this fungus. The spores are quite smooth and are not warted as described and figured by *Bresadola*. The warts depicted by this author do not belong to the epispore membrane but to the protoplasm.

2. *Omphalia Allenii* n. sp. see pl. 11.

Hygrophanous; Pileus 1-2 cm. wide, convex then plane, *somewhat umbilicate, even, glabrous*, thin, *olive-greenish*, whitish when dry. Gills decurrent, *very narrow*, somewhat thick and distant, unequal, more or less undulating, united by veins, *lemon-yellow*. Stem cylindrical, *hollow*, even, glabrous, subcartilaginous, *lemon-yellow*, base whitish and strigose. Flesh yellow in the stem, greyish yellow in the pileus. Taste mild, smell none. Spores whitish in the mass as deposited on black paper, hyaline, elliptical, smooth $6{\cdot}5\text{-}7{\cdot}5 \times 3{\cdot}5\text{-}4\mu$. Basidia clavate $20\text{-}27 \times 5\mu$, 4-spored. Cystidia none. Edge of gills homomorphous. Subhymenium thick, branching, dense, middle layer subintricate. On an old stump of a deciduous tree at the south end of Manners Wood, near Bakewell.

This fungus is closely allied to *Omphalia xanthophylla* Bres. and *O. chrysophylla* Fr. It differs from the former in its olive-green not virgate pileus and the yellow stem and from the latter by its smaller spores and the olive-green smooth pileus. *O. Wynniae* (Berk.) Quél. differs in being pellucid, striate, yellow in every part but changing to a greenish tint with loss of moisture and in its broader spores.

Named in honour of *Mr. W. B. Allen* an eminent mycologist and member of the British Mycological Society.

3. *Hygrophorus Colemannianus* Blox. in Berk. Outl. p. 200.

This fungus grew abundantly in the pastures at Baslow and is met with also in France. It is well represented by the figure No. 213 of *Patouillard Tabulae Analyticae* under the name of *H. streptopus* Fr., but it is not identical with this. Patouillard's fungus was gathered in the Jura mountains, where I have recently found it again. Bresadola points out and I can confirm him that this species belongs to the *Camarophyllus* section and is very nearly allied to *H. pratensis* (Pers.) Fr. and not to the *Hygrocybe* section where it was originally placed.

4. *Hygrophorus (Hygrocybe) Reai* n. sp. See. pl. 11.

Stem 3-6 cm. long, 2-3 mm. thick, *viscid*, glabrous, shining, hollow, somewhat tough, orange-scarlet to yellow, base whitish. Pileus 1·5-2·5 cm. wide, fleshy, thin, convex-campanulate then plane, scarlet; margin orange-yellow or yellow, slightly striate when moist; no separable pellicle. Gills *broadly adnate* with a decurrent tooth, broad, thin, unequal, not crowded, flesh-coloured then orange, edge whitish then yellow. Flesh orange, *very bitter*. Smell none. Spores in the mass white, hyaline, elliptical, smooth, apiculate $7\text{-}8 \times 3{\cdot}5\text{-}4{\cdot}5\mu$. Basidia clavate $35\text{-}40 \times 7\text{-}8\mu$, four-spored. Edge of gill homomorphous. Subhymenium thin, branching; middle layer regular. Cystidia none.

In pastures on Millstone grit near Baslow, Chatsworth Park. Also in France and Sweden.*

This pretty species is easily distinguished by its *bitter taste* and *viscid stem* from its allies *H. coccineus* Fr., *H. miniatus* and *H. turundus* Fr. Named in honour of Mr. Carleton Rea, the Hon. Secretary of the British Mycological Society.

5. *Entoloma griseocyaneum* Fr. Syst. Myc. I. p. 202, var. *roseum* n. var. and see pl. 11.

This variety differs from the type in having a pink stem and the pileus is pale pink with darker scales.

In pastures at Baslow, along with the type.

This fungus when young very closely resembles *Tricholoma carneum* (Bull.) Fr.

6. *Leptonia Reaae* n. sp. see pl. 11.

Stem 2-3 cm. long, 1-5 mm. thick, equal, flexuous, *wavy*, glabrous, shining, dry, deep blue or blue-black, then often

* Since found in Worcestershire and Shropshire.—C. R.

vinous, stuffed then holow, obsoletely whitish-mealy at the apex. Pileus ·5-1 cm. broad, *convex then expanded*, submembranaceous, disc fleshy, *even*, *smooth*, dry, *not or only slightly hygrophanous*, rarely umbonate or papillate at maturity; cuticle not separable; margin slightly incurved at first, then expanded and sometimes somewhat striate. Gills somewhat crowded, *short, broad, broadly and deeply sinuate, narrowly adnate* then free, *whitish* then greyish-pink. Flesh vinous, mild in taste; smell none. Spores salmon colour in the mass, pale pink, obsoletely polygonal, subglobose, 8-10 (including the apiculus) × 7-8μ, containing many oil drops. Cystidia none. Basidia 4-spored, clavate, 39-40 × 8-10μ. Edge of gills homomorphous, middle layer regular subhymenial layer very thin and branching.

In pastures on Millstone Grit near Grindleford, Baslow, Chatsworth.

Named in honour of Mrs. Carleton Rea, the wife and indefatigable assistant of the Hon. Secretary of the British Mycological Society, whose beautiful paintings of fungi are admired by all mycologists and in memory of our forays together in the Vosges and Derbyshire. This fungus is easily distinguished by its short, broad gills, wavy stem, and the pileus is not umbilicate but is sometimes papillate. It is very nearly allied to the blue species of *Nolanea*, but the incurved margin at first and flat pileus range it in the genus *Leptonia*.

7. *Cortinarius praestans* [Cordier, Champ. France, p. 98, t. 26 (1870), *sub Agarico*] Sacc. Syll. xi. p. 65—*C. Berkeleyi* Cooke, Handb. Brit. Fung. ed. 2, p. 240 (1883), Illustr. Brit. Fung. t. 699 (706) et 700 (707)—*C. anfractus* Berk. Outl. p. 184, non Fr.—*C. variicolor* var. *herculeanus* Fr. Mon. Hym. II. p. 307, Icon. Sel. II., p. 43, t. 144, fig. 1.—*C. variicolor* Alb. et Schw. Consp. Fung. Nisk. p. 153, *sub Agarico*! an Pers.?; Britz. Cort. fig. 93!—*C. torvus* Kalchbr. Ic. Sel. Hym. Hung., t. 21, fig. 1! Quél. Enchirid, p. 85, Fl. Myc. p. 187!, non Fr.!

Cooke rightly controverted *Kalchbrenner's* and *Quélet's* determination of this species which they erroneously referred to *C. torvus* Fr., which is quite a distinct species. *C. praestans* was little known to *Fries* and was only once found by him in Sweden, where it is very rare. I have since ascertained by studying the original plates of *Fries* at Stockholm that the typical *C. variicolor* Fr. is the plant described by *Gillet*, *Cooke* and *Lucand*, which is a smaller species very nearly allied to *C. largus* Fr. *C. praestans* Fries represents in his *Icones* and describes as a variety *herculeanus* of *C. variicolor*, but it is really a very distinct species. The first authentic name for *C. praestans* was *Agaricus variicolor* Alb. et Schw., but this fungus is not the

same as the *A. variicolor* of Pers. The next authentic name is *C. variicolor* var. *herculeanus* Fr. but the adoption of this name is prevented by the Vienna rules when a variety is raised to specific rank, and so the first available name is *C. praestans* Cordier.

8. *Russula grisea* (Pers. Syn. p. 445, *sub Agarico*) Bres. Fung. Mang. p. 79, t. 77! and see pl. 13.

This very distinct species has not hitherto been recorded for Great Britain because it has been overlooked or mistaken for other species. It is very likely that Cooke's plates 999 (1053) and 1077 (1008) represent this species.

Specimens of this species were gathered by me in Chatsworth Park.

9. *Russula subfoetens* Sm. Journ. Bot. 1873, p. 337. Cooke, Illustr. of Brit. Fungi, t. 1016 (1047); Gillet, Champ. France, t. 637.—*R. farinipes* Romell in Britz. Mat. z. Beschr. d. Hymenom. in Bot. Centr. 1893, no. 15-17, Hym. Sud-bayern, fig. 106!

This Russula is quite a distinct species and is not a sub-species or variety of *R. foetens* Fr., to which *Bataille* refers it in his Flore monographique des Astérosporées, p. 75. This plant is tough and elastic, as both *Smith* and *Cooke* have pointed out, moreover the spores deposited in mass are pure white, whereas those of *R. foetens* are yellowish white. Its chemical reaction to alcoholic solution of guiacum is very different, with *R. foetens* a brilliant blue reaction is produced, whereas with *R. subfoetens* it has no effect at all except occasionally in young specimens and then it only affects the cuticle of the pileus. I have never found that *R. subfoetens* has any characteristic smell. The British specimens gathered at Chatsworth are identical with those I have found in France and Sweden.

10. *Corticium atrovirens* Fr. Elench. Fung. p. 202, *sub Thelephora;* Epicr. p. 562; Bres. in Ann. Mycol. I. p. 96!—*Hypochnus chalybaeus* Lehröt., Pilz. Schles. I. p. 416! *Lyomyces caerulescens* Karst., Hattswamp II., p. 154.

On Oak-bark, Baslow.

The spores of this fungus are pale bluish green, not hyaline, and it forms an intermediate stage between the genus *Corticium* and *Coniophora.*

11. *Stereum gausapatum* Fr. Elench. Fung. I. p. 171, Bres. in Atti Accad. Rovereto, ser. 3, vol. 3, p. 105—*S. spadiceum* Fr. Elench. p. 176, non Pers.—*S. cristulatum* Quél. Jur. et Vosges, III., p. 15, t. 1, fig. 15.


Taste bitter.
A
× 5-7 μ.
B.
× 5-6 μ
C.
6-8 × 3-4 μ
E
4-5 × 4 μ,
5-6 × 3 μ.
D.
5-6 × 4 μ.
7-8 × 3·5-4·5 μ.
Hygrophorus Reai *Maire.*
× 400
Clavaria persimilis *Cotton.*
7-7·5 × 5 μ
Hygrophorus citrinus *Rea.*
Smell
very pleasant.
10-11
× 7-8 μ.
Entoloma griseocyaneum *Fr.*
var. roseum *Maire.*
Cells at the edge of the gills.
8-10 × 7-8 μ
6·5-7·5 ×
3·5-4 μ
E.A.Rea del.
West, Newman chr.
Leptonia Reaae *Maire.*
Omphalia Allenii *Maire.*

On Oak-stump near Grindleford.

This fungus is quite a distinct species and not a variety of *S. hirsutum* as both *Massee* (Brit. Fung. Flora) and *Cooke* (Field Book) assert.

S. gausapatum differs from *hirsutum* in becoming red when bruised and in having larger and broader spores.

12. *Dacryomitra glossoides* (Pers. Syn. p. 596, *sub Clavaria*) Bref. et Istvánffi, Unters,vii., p. 162, t. xi., f. 1, *Calocera glossoides* Fr. Syst. Myc. I., p. 487.

On rotten Oak wood, Grindleford.

FUNGAL PARASITES OF LICHENS.

By A. Lorrain Smith, F.L.S.

While preparing the second volume of the "Catalogue of British Lichens" for the Trustees of the British Museum I have had to take into consideration a number of species that have been variously classified as fungi or lichens. They are pyrenomycetous forms and are embedded in, or almost sessile on, the thallus and fruits of various crustaceous and other lichens (*Lecanora*, *Lecidea*, *&c.)*; so far as is yet ascertained they are entirely parasitic and do not enter into symbiotic relationship with the gonidia of the lichen-host. Some of them have been already published in the Transactions.

Ticothecium gemmiferum Koerb. Pareeg. p. 468 (1865) Mass. in Grevillea xvii., p. 4. *Verrucaria gemmifera* Tayl. in Mackay Fl. Hib. 11, p. 95 (1836). *V. rugulosa* Borr. ex Leight. Angioc. Lich., p. 47, t. 21, fig. 1 (1851). *V. Larbalestierii* Leight. in Trans. Linn. Soc. Ser. 2, 1, p. 242, t. 33, figs. 15-17 (1878).

Perithecia scattered, immersed, minute, globose, beaked, later collapsing; paraphyses in a gelatinous mass; asci clavate thick-walled, 30-36μ x 10-12μ, 8-spored; spores ellipsoid or elongate-ellipsoid, blunt at the ends, 2-celled, sometimes slightly constricted, brown, 8-12μ x 3-4μ.

Parasitic on *Lecidea contigua*, frequent.

T. calcaricolum Arn. in Verh. Zool.—Bot. Ges. xxiii., p. 521 (1873); Mass. in Grevillea xvii., p. 4. *Microthelia calcaricola* Mudd Man. p. 306, t. 5, fig. 128 (1861). *Endococcus calcareus* Nyl. ex Cromb. Lich. Brit. p. 122 (1870).

Perithecia moderate in size, black, scattered, superficial or the base immersed, globose with rather a large pore; spores brown, ellipsoid-oblong, 1-septate, 19-20μ x 6μ.

Parasitic on *Lecanora cinerea*, *L. calcarea* and *L. gibbosa*.

T. perpusillum Arn. in Flora LVII., p. 27 (1874); Mass. in Grevillea XVII., p. 4. *Endococcus perpusillus* Nyl. in Act. Soc. Linn. Bord Sér. 3, I., p. 439 (1856).

Perithecia minute, immersed, depressed, globose, black;

spores 8 in the Ascus, brown, 2-celled, $14\text{-}19\mu \times 6\text{-}7\mu$.
Parasitic on *Lecanora cinerea* and *L. gibbosa.*

T. pygmaeum Koerb. in Denkschr. Schles. Ges. Vaterl. Kultur. p. 236, t. 6, fig. 12 (1853). (See Trans. Brit. Myc. Soc. ii., p. 61.)

Var. ventosicola Wint. in Rabenhorst's Krypt. Fl. 1, 2, p. 349 (1887). *Microthelia Ventosicola* Mudd Man. p. 307 (1861). *Sphaeria ventosaria* Lindsay in Trans. Roy. Soc. Edin. XXIV., p. 439 (1866). *Endococcus ventosus* Nyl. ex Cromb. Lich. Brit., p. 123 (1870).

Scarcely differing from the species. Perithecia semi-immersed in small warts of the thallus; spores $8\text{-}9\mu \times 5\mu$.
Parasitic on *Lecanora ventosa.*

T. erraticum Massal. Symm. Lich. p. 94 (1855).

Perithecia semi-immersed, globose, with indistinct ostiole, shining black, about $\frac{1}{2}$ mm. in diameter; Asci elongate, cylindrical-clavate, with numerous (60 or more) spores; spores broadly elliptical or almost globose, 1-septate, dark brown, $7\text{-}10\mu \times 4\text{-}6\mu$ fide Nyl. Lich Scand., p. 283 (1861).

Winter (Tom. cit. p. 350) gives the size of the spores as $3{\cdot}5\mu \times 2{\cdot}5\mu$.

Parasitic on the thallus of various Lichens. Dorset, Mr. E. M. Holmes.

Subsp. *microphorum* A.L.Sm. *Endococcus erraticus* subsp. *microphorus* Nyl. in Flora LXIV., p. 189 (1881).

With smaller spores than the species $4\text{-}7\mu \times 2\text{-}3\mu$ Wint.
Parasitic on the thallus of various crustaceous Lichens. Cardiganshire (W. Joshua).

T. rimosicolum Arn. in Flora XLIV., p. 678 (1861); Mass. in Grevillea XVII., p. 5. *Microthelia rimosicola* Mudd Man. p. 308 (1861). *Verrucaria advenula* Nyl. in Flora XLVIII. p. 606 (1865). *V. peripherica* Tayl. in Mackay Fl. Heb. ii., p. 97 (1836)? *Endococcus periphericus* Cromb. Lich. Brit. p. 123?

Perithecia scattered, sometimes crowded, entirely or semi-immersed, depressed-globose; asci ovoid-clavate, 8-spored; paraphyses indistinct; spores ellipsoid or ellipsoid-oblong, the ends usually tapering, 3-septate, slightly constricted at the septa, clear brown, $13\text{-}16\mu \times 5\text{-}6\mu$.

On the thallus of *Rhizocarpon subconcentricum, Rh. confervoides,* &c.

T. cerinarium Berl. and Vogl. in Sacc. Syll. Fung. Add, p. 120 (1886) Mass. in Grevillea XVII., p. 5. *Sphaeria cerinaria* Mudd Man., p. 136 (1861).

Perithecia minute, punctiform, semi-immersed, black, scattered; paraphyses none; asci not seen; spores oblong, slightly constricted, 1-septate, pale yellow.

Parasitic on the apothecia of *Lecanora cerinaria*.

Collected by Mudd near Ayton, Cleveland, Yorkshire.

T. squamarioides Wint. in Hedw. XXV., p. 17 (1886). *Sphaeria squamarioides* Mudd Man., p. 130 (1861).

Perithecia in small groups, minute, black; Asci elongate-oblong or slightly clavate, 8-spored; paraphyses indistinct, mucilaginous; spores fusiform, 2-celled, slightly constricted, dark olive-brown or almost black, 8-11μ × 3-4μ.

Parasitic on the thallus of *Lecanora gelida*.

Didymosphaeria gelidaria A. L. Sm. *Sphaeria gelidaria* Mudd Man., p. 130 (1861). *Ticothecium gelidarium* Berl. and Vogl. in Sacc. Supl. Fung. Add., p. 118 (1886); Mass. in Grevillea XVII., p. 4.

Perithecia forming black spots, scattered; paraphyses distinct, lax, flexuose, somewhat involved in mucilage; asci short, cylindrical, 4-spored, constricted opposite each spore; spores subrotund or broadly-oblong, their outline irregular, filled with a dark red or nearly black protoplasm, obscurely bilocular, 8-11μ long and very narrow.

Parasitic on the thallus of *Lecanora gelida*. Collected by Mudd at Teesdale, Durham. Included in *Didymosphaeria* on account of the distinct paraphyses.

D. microstictica Wint. in Hedwigia XXV., p. 25 (1886). *Verrucaria microstictica* Leight. Lich. Fl. p. 461; ed. 3, p. 493.

Perithecia minute, black, immersed or semi-immersed, globose, depressed, the ostiole a minute pore; asci cylindrical, shortly stalked, 8-spored 78-88μ × 10μ; spores elliptical-oblong, 1-septate, constricted, black, 14μ × 7μ; paraphyses numerous, slender branched and entangled.

Parasitic on the thallus of *Lecanora cervina*.

Collected by Leighton at Borthwen, Barmouth, Merioneth.

D. epipolytropa Wint. in Rabenhorst's Krypt,—Flora I., 2, p. 432 (1887). *Thelidium epipolytropum* Mudd Man., p. 298 (1861). *Verrucaria epipolytropa* Cromb. Lich. Brit., p. 121 (1870).

Perithecia scattered, minute, immersed or semi-immersed,

globose, black, somewhat depressed above; paraphyses distinct slender, branched; asci shortly cylindrical or oblong-clavate, 4-8-spored; spores elongate-oblong, or almost fusiform, 1-septate, colourless, 15-18$\mu \times$ 4-5μ.

Parasitic on the thallus of *Lecanora polytropa*.

D.? neottizans A. L. Sm. *Verrucaria neottizans* Leight. in Linn. Trans. Soc. Ser. 2, 1, p. 239, t. 32, fig. 19 (1878).

Perithecia black, minute, clustered, hemispherical-conical; perithecial wall carbonaceous; paraphyses distinct, slender; spores 4 in the ascus, linear oblong, 3-septate, constricted at the septa, brown, 24-25$\mu \times$ 8-9μ. Specimen not seen.

Parasitic on *Baeomyces rufus* very rare. Collected at Llanachar Bridge, near Fishguard, Pembrokeshire.

Physalospora ? psoromoides Wint. in Hedwigia XXV., p. 23 (1886). *Verrucaria psoromoides* Borr. in Engl. Bot. Suppl. t. 2612, fig. 1 (1829). *Endocarpon psoromoides* Hook. in Sm. Engl. Fl., p. 157 (1833).

Perithecia congregate, immersed in the thallus, almost globose, with a wide ostiole, of delicate, soft texture; paraphyses indistinct, mucilaginous; asci oblong, narrower at each end, 8-spored; spores ellipsoid-oblong, or ovoid, simple, colourless, 12-14$\mu \times$ 5μ.

Parasitic on the thallus of *Physcia pulverulenta* and *Lecanora mutabilis*.

Pharcidia dubiella A. L. Sm. *Verrucaria dubiella* Nyl. in Flora XLVIII., p. 356 (1865); *V. endoccoidea* Nyl. l.c.

Perithecia minute, black, entirely surrounded by a black wall; paraphyses none; spores 8 in the ascus, colourless, oblong, slightly tapering at the ends, 3-septate, 16-21μ long, 6-7μ thick; hymenial gelatine, wine red with iodine.

Hab. On a whitish squamulose lichen. On decaying mosses in damp situations. Ben Lawers, Perthshire. (Herb. Carroll).

The specimen of *Ph. dubiella* in the herbarium of the British Museum is too small for examination, but there seems no doubt that it is as Nylander (l.c.) suspected, a parasitic fungus: the specimen of *V. endoccoidea*, also parasitic, from the same locality agrees entirely with it in perithecia and spores.

Ph. ? triphractoides A. L. Sm. *Endococcus triphractoides* Nyl. ex Cromb. in Grevillea III., p. 24 (1874). *Verrucaria triphractoides* Leight. Lich. Fl. ed. 3, p. 497 (1879).

Perithecia minute, black, hemispherical, spores 8 in the ascus, oblong-fusiform, colourless or pale-brownish, 3-septate, 14-18$\mu \times$ 6-7μ. Specimen not seen.

Parasitic on the thallus of *Lecidea scotinodes*. Collected by Crombie at Craig Tulloch, Blair Athole, Perthshire.

Massaria scoriadea Cooke in Grevillea XVII., p. 93 (1889). *Verrucaria conferta* Tayl. in Mackay Fl. Heb. ii., p. 87 (1836).

Müllerella polyspora Hepp. ex Muller in Mem. Soc. Phys. Hist. Nat. Genève XVI., p. 420 (1862). *Endococcus haplotellus* Nyl. in Flora L., p. 180 (1867) ; Carroll in Journ. Bot. VI., p. 101 (1868). *Verrucaria haplotella* Leight. Lich. Fl. p. 463 (1871), ed. 3, p. 495. See Trans. Brit. Mycol. Soc. III., p. 116.

NOTES ON BRITISH CLAVARIAE iii.

By A. D. Cotton, F.L.S.

During the past two years the writer has received a large number of Clavarias, the examination of which has been of great value in the systematic revision of the European species. Repeated handling renders familiar the essential features of the different species and several points have been cleared up which were previously obscure Much work still remains to be done, and it is increasingly emphasized that only by a study of ample material extending over a long period, can the revision be brought to a successful issue.

Each season supplies species not hitherto examined, and 1909 being no exception in this respect, it is obvious that the time has not come for bringing the investigation to a close. The most trying and difficult part of the work is not however the obtaining of rare and little known species, but that which concerns the names given by the pioneers of mycology, such as Schaeffer and Persoon. These names cannot be ignored, as they have been employed by later writers and are more or less in use at the present day; but the time and labour involved in endeavouring to identify the species and to extricate the names from subsequent confusion, can only be understood by those who have worked at this branch of systematic botany. But here again experience based on the study of living material gives sounder judgment.

The season 1909 seems to have been particularly favourable for Clavarias, a larger number having been observed personally by the writer than in any year since the beginning of the investigation (1903). White-spored species were particularly abundant, whilst species of the *Ochrosporae* section were almost entirely absent. In previous seasons about 20 per cent. of the specimens examined consisted of yellow-spored species, whereas in 1909 the proportion was only 4 per cent.

The following notes give some of the results of recent investigations; they contain revised descriptions of *C. Kunzei* Fr., *C. umbrinella* Berk., *C. tenuipes*, B. & Br.; the description of a new species *C. persimilis*, and remarks on the synonomy of *C. grisea* Pers. and *C. cinerea* Bull.

1. *C. Kunzei* Fr., Syst. Myc. vol. 1, p. 474; Berk. Outl., p. 280; Cooke Handb., p. 333; Fr., Hym. Eur., p. 669; Stev., Brit. Fungi ii., p. 293; Massee, Brit. Fung. Flora, vol. 1, p. 78. *C. chionea* Pers., Myc. Eur., Sect. 1, p. 167.

Plants medium sized, 5-12 cm. high, branched, isolated or gregarious, brittle, ivory to creamy white, base sometimes pink. Branching irregularly dichotomous, or irregular, loose or rarely compact. Branches erect or spreading, cylindrical or slightly compressed, often elongated, 2-5 mm. thick, even, solid, axils lunate, apices blunt or pointed. Stem usually distinct, 1-2 cm. long, 3-5 mm. thick. Internal structure pseudoparenchymatous in transverse section, cells long, $100\text{-}300 \times 5\text{-}8\mu$. Basidia small $30\text{-}35 \times 5\text{-}6\mu$, 4-spored. Spores hyaline, smooth, guttulate, globose, very small, $3{\cdot}5 \times 4{\cdot}5\mu$, minutely apiculate. Smell none. Taste?

Hab. In long grass in woods and pastures, uncommon. Specimens examined from:—Little Eaton (A.D.C. Midl. Ry. foray '05); Bexhill (E. W. Swanton '08); Little Eaton (H. C. Hawley, Midl. Ry. foray '08); Drumnadrochit (A. Grant '08); Broseley (W. B. Allen and G. Potts '09); Chatsworth House Grounds (A.D.C. foray '09).

This species when once recognised is not likely to be mistaken for any other, its beautiful ivory-white colour, and loosely branched habit at once marking it out as distinct. When well grown it may form tufts 4 to 5 inches high and as much across, but average plants are decidedly smaller. From *C. rugosa* it is distinguished by being branched from the base and by the slender, even (not rugose) branches, and from *C. cristata*, by the loose habit, lunate axils, and non cristate apices, whilst from both it differs in the very small spores. The only other British white Clavaria of the Ramaria section with which it can be confused is *C. Krombholzii*, a plant which is possibly only a dwarf form of the present species.

As no type specimens of *C. Kunzei* exist it was necessary to rely on the original description by Fries and the figures quoted by him. The plant here described agrees in every way with Fries' description, and the writer has no doubt that it has been correctly identified. It is not uncommon and Fries could hardly have overlooked it, and yet no other species is described by him (except *C. Krombholzii*) to which it could be referred. In addition to this no plant has been received during the past six years that could make a rival claim to the name.

The history of *C. Kunzei* in mycological literature may be briefly stated as follows. Originally described by Fries in 1821 it was united by him (Epicrisis, p. 573) to *C. chionea*, a plant described by Persoon in 1822. (An examination of the type specimens of the latter kindly lent by Dr. Goethard from

Leiden, show that this view was probably correct. Fries's name has, however, priority by one year.) In the same work Fries described a new species, *C. Krombholzii*, and refers to figures by Krombholz (Tafeln tab. 53, fig. 15 and 16, and tab. 54, fig. 18-20) which that author had named *C. Kunzei*. The new species differed principally in being less branched and the branches being somewhat flattened. In *Hymenomycetes Europaei* (1874) the same distinctions between these two species are kept up by Fries, with a few additional references to old names and figures. *C. Kunzei* was first recorded as British by Berkeley in 1860 (Outlines, p. 280), and *C. Krombholzii* by Berkeley and Broome in Ann. and Mag. of Nat. Hist. 1876, p. 138, No. 1586.

The validity of *C. Krombholzii* as a species is as stated above doubtful. *C. Kunzei* is well known to be a very variable plant, and it sometimes assumes forms which correspond with the description given for *C. Krombholzii*. None of the plants yet seen by the writer placed under the latter name can be regarded as specifically distinct from *C. Kunzei*.

2. *Clavaria umbrinella* Sacc. Syll. vol. VI., p. 695; Massee Brit. Fung. Flora, vol. I., p. 77. *C. umbrina*, Berkeley Outlines, p. 279, Pl. 18, fig. 4 (poor); Cooke Handb., p. 332; Fr., Hym. Eur., p. 668; Stev., Brit. Fungi, p. 292.

Plants small, 1-1½ inches high, branched, isolated or caespitose, pale brown. Branching irregularly dichotomous. Branches erect, cylindrical, slender, 1-2 mm. thick, even, solid; apices blunt or bifid. Stem absent, branches distinct to base. Internal structure composely of loosely and slightly interwoven filaments, 7-10μ diam. Basidia small $35\text{-}40 \times 6\text{-}7\mu$, contents finely granular, sterigmata 4. Spores hyaline smooth, usually guttulate, pip-shaped $4\text{-}5 \times 4$ or $5\text{-}6 \times 3\mu$. Smell none. Taste pleasant.

Hab. On lawns, uncommon. Specimens examined from:— Epping Forest (A.D.C., 1908); Chatsworth House Grounds (A.D.C., 1909); Boston (H. C. Hawley, 1909); Broseley (G. Potts, 1909). Downs near Brighton (H. C. Hawley, 1909).

C. umbrinella is a well-marked and somewhat uncommon species occurring on lawns. It is distinguished by its short branched habit, like that of *C. muscoides* var. *fastigiata*, and by its pale brown colour.

A good deal of uncertainty has existed as to its identity, owing partly to the poorness of Berkeley's figure and partly to inaccuracies by later writers. Part of the original gathering exists at Kew, and though somewhat decayed and covered with Penicillium shows the characteristic spores (see Plate 11, fig. E). The specimens taken together with Berkeley's description and his rider "The habit is that of *C. fastigiata*" leave no doubt as to the plant he had in view. The statement that the plant is

probably a small dingy form of *C. cristata* is due to the examination of a mis-determined gathering.

3. *Clavaria tenuipes*, B. & Br., in Ann. and Mag. Nat. Hist. ser. ii., vol. ii., 1848, p. 266, tab. 9, fig. 2; Berk. Outlines, p. 282; Cooke Hanb., p. 336. *Pistillaria tenuipes*, Massee, Brit. Fung. Flora, vol. i., p. 91.

Plants small, isolated or in small groups, pale grey to drab-coloured. Clubs 3-6 cm. high, clavate or cylindrical, often compressed, 2-10 mm. wide, smooth or slightly rugulose, hollow when old, apex blunt. Stem slender, 1-2 cm. long, 2-3 mm. wide, more or less sharply marked. Internal structure composed of loosely packed oblong cells 8-10μ diam. Basidia rather small, 30-40 × 7-9μ, contents granular, sterigmata 4 erect. Spores hyaline, smooth, guttulate then granular, ovoid, av. 8 × 4μ (7-9 × 4-5μ) with a minute basal apiculus.

Habitat. In short grass specially in heathy places. Specimens examined from:—Wisley (G. Massee, 1906); Farnley Tyas foray (C. Crossland 1906); Bakewell and Grindleford (A.D.C., foray 1909); Broseley (G. Potts, 1909); Epping Forest (Miss G. Lister, 1909); Kew Gardens (L. A. Boodle, 1909).

The type specimens of this species are in the Kew Herbarium, and clearly indicate its identity should any doubt exist as to the original description. The plant is readily recognised by its greyish or drab colour, and by its more or less thickened fleshy club and slender stem. The name is often wrongly applied to *C. acuta* Sow., an entirely distinct species differing in the slender, very fragile snow-white sporophores (see Transactions, vol. ii., 1907, p. 31). The stem in some specimens is sharply separated from the spore-bearing surface; in others the transition is not so abrupt. In texture the plant is somewhat tough. This character has led to its being placed in *Pistillaria*, a genus composed of minute plants, all of which are epiphytic on dead leaves and stems. The present plant is however a genuine *Clavaria*.

C. tenuipes is found especially on heathy ground, as were indeed Berkeley's original specimens. It also occurs on lawns and in short grass generally.

4. *Clavaria persimilis* sp. nov. See pl. 11.

* Plants small, unbranched, isolated or fasciculate, orange-yellow to orange, becoming darker on drying. Clubs slender,

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* *Plantae minutae. simplices, sparsae v. fasciculatae, aurantiacae siccitate rubescentes. Clavuli graciles, 3-5 cm. alt., 2-3 cm. cr., cylindracei v. complanati, apice acuta. Basidia clavata, 30-35 × 7-8μ, sporis hyalinis, levibus, oblongo-subglobosis 5-6 × 4μ, apiculo conspicue laterale. Hab. ad terram graminosam.*

3-5 cm. high, 2-3 mm. thick, cylindrical or somewhat compressed, apex usually acute. Stem not sharply defined. Flesh pale. Internal structure composed of loosely packed longitudinally-running filaments 3-6μ diam., not pseudo-parenchymatous in transverse section. Basidia small 30-35 × 7-8μ, contents granular, sterigmata 4 erect. Spores hyaline, smooth, guttulate, subglobose-oblong, 5-6 × 4μ, with a conspicuous oblique apiculus.

Hab. In short grass not uncommon. Specimens examined from:—Bristol (Miss A. Fry, 1905); Haslemere (A.D.C. foray 1905); Kew Gardens (G. Nicholson 1907); Falmouth (Miss A. Fry, 1907); Alnwick (A.D.C. foray 1907); Boston (H. C. Hawley, 1908); Whitby (C. Crossland, 1908); Clare Island, Ireland (H. C. Hawley, 1909); Broseley (W. B. Allen and G. Potts, 1909); Grindleford and Chatsworth (A.D.C. foray 1909). Pl. 11, fig. D.

The present species is very similar to *C. luteo-alba* Rea; and even with a measure of experience it is difficult to distinguish it in the field. An unfailing character is found in the spore, which is ovoid and non-apiculate in *C. luteo-alba*, and sub globose to oblong in *C. persimilis*, with a very well marked oblique apiculus. This character separates it at once, and is in itself quite sufficient to mark it as specifically distinct. It differs however in other characters, namely, in the different shade of colour when fresh, the absence of a white tip and in becoming dark orange on drying. Our four yellow unbranched Clavarias may be distinguished as follows:—

C. fusiformis Sow., large, tufted, sporophores connate at base, apices pointed, colour canary yellow. Taste bitter. Spores smooth, globose, 5-7μ diam., minutely apiculate. Common. (Pl. 11, fig. A.)

C. inaequalis Müller (=*C. dissipabilis* Britz.). Single or in small groups, clubs clavate, blunt or sometimes cylindrical. Colour deep yellow to orange yellow. Spores subglobose 5-6μ diam., sharply warted. Very common; in woods, lawns, parks, etc., variable in size. (Pl. 11, fig. B.)

C. luteo-alba Rea. Small and slender. Colour apricot, apex often white. Spores ovoid, non-apiculate, 6-8 × 3-4μ. Pale buff on drying. (Pl. 11, fig. C.)

C. persimilis Cotton. Small and slender. Colour orange. Spores subglobose to oblong, 5-6 × 4μ, obliquely apiculate. Dark orange on drying. (Pl. 11, fig. D.)

The last two species are much smaller than the two former and seldom exceed an inch and a half in height. They are not uncommon but are apt to be overlooked unless specially searched for.

5. *Clavaria cinerea* Bull. (1791) and *C. grisea* Pers. (1797).

From what is stated below it will be seen that *C. grisea* Pers., the identity of which has always been doubtful, must be regarded as a synonym of *C. cinerea* Bull.

C. grisea was described by Persoon in 1797 (Comm., p. 44). In 1822 (Mycologia Europaea, p. 166) he united it with *C. cinerea* under the common name of *C. fuliginea.* Fries in 1821 (Syst. Myc., p. 468) has *C. grisea* and *C. cinerea* as two distinct species, and in addition to giving certain differences of form, quotes a statement by Persoon that in *C. grisea* the branches are covered with brown-red spores.

Later on (Epicrisis, pp. 472 and 475) Fries places *C. cinerea* in *Leucosporae* and *C. grisea* in *Ochrosporae.* Nearly all recent writers have followed Fries in this respect, and to-day *C. grisea* is regarded as a plant having the habit of a stout *C. cinerea* but differing essentially in its yellow brown spores. During the past six seasons no plant answering to this description has been met with, and suspicions as to *C. grisea* were aroused. The only way of settling the difficulty was by an examination of Persoon's specimens, and through the kindness of Dr. Goethard these were sent on loan from the Persoon Herbarium at Leiden. Four distinct gatherings labelled *C. grisea* in Persoon's own hand exist. In each gathering the spores were found to be precisely similar to the large subglobose hyaline spores of *C. cinerea.* In form the specimens also agreed with that species. There is no doubt therefore that, as stated by Persoon himself, *C. grisea* is a synonym of *C. cinerea.* A possible explanation of the wrong idea which arose as to the spore-colour of *C. grisea*, may be found in the fact that the spores of *C. cinerea* become with age pale yellow, just as do those of certain white-spored Agarics. When fresh they are always hyaline, and in mass white.

Explanation of Figures.

Plate XI.

Fig. A.	*Clavaria fusiformis* Sow.	Spores × 800.
Fig. B.	*C. inaequalis* Mueller.	Spores × 800.
Fig. C.	*C. luteo-alba* Rea.	Spores × 800.
Fig. D.	*C. persimilis* Cotton.	Spores × 800.
Fig. E.	*C. umbrinella* Sacc.	Spores × 800.

NOTES ON THE MYCETOZOA COLLECTED AT THE BASLOW FORAY.

By W. B. Allen.

The Annual Foray of the British Mycological Society held at Baslow, Derbyshire, was remarkable for the numerous species of Mycetozoa that were collected. At no previous meeting of the Society has such a long list been compiled, which is all the more noteworthy since the woods, which were visited, were very rocky and not particularly rich in old timber or rotting logs.

Saw mills and old timber yards, always a joy to the collector of Mycetozoa, abound in the vicinity of Baslow, but, strange to say, they provided only an abundance of common species, the most choice collections all coming from Sheriff's Wood, near Grindleford.

The climatic conditions, during the Foray, were everything that could be desired; a warm humid atmosphere prevailed, in which the plasmodia appeared to revel; indeed a large proportion of the gatherings were made in this immature state, some of which did not develop as well as one would have wished, in the very drying air of the Exhibition Room.

All the species were submitted to Miss G. Lister, F.L.S., who kindly verified and corrected names for me and gave notes upon any that were of sufficient interest to call for remark.

The list comprises 39 species and some varieties (see p. 148), a good representation of ordinary species, with some notable exceptions.

The Foray was timed to commence on Tuesday, September 28; several members, however, assembled for the previous week-end, and it was on these days prior to the Foray proper, that the chief discoveries were made in the way of Mycetozoa.

The following species are worthy of comment:—

Badhamia utricularis Berk.

I gathered a plentiful supply of the plasmodium of this species in the estate sawyard at Chatsworth. Mr. Cotton kindly handed me a nice gathering of perfect sporangia, fine and typical, with the spore-clusters rather larger than usual, running up to 20 spores in a group.

Physarum nutans Pers. was excessively abundant in every wood visited, whilst *P. viride* Pers. was comparatively rare, only one or two scattered sporangia being secured in Yeld Wood, and a few more in Manners Wood.

P. Diderma Rost. was only once taken on decaying leaves of a *Carex* in a very boggy spot, the sporangia being long and sinuous of the form more usually assumed by *P. bivalve* Pers. In Shropshire I can generally find *P. Diderma* Rost. by grubbing at the base of some large blackberry bush, as this species appears to have a partiality for the decaying stems of *Rubus* which fall into the interior of the bush. In such situations, I have always found the sporangia scattered and of the first form given in the "Guide to Mycetozoa," viz., "subglobose." I had never before seen them of the second form, viz., "elongate compressed plasmodiocarps," which was the form assumed by the Derbyshire specimens, consequently I was not successful in naming the gathering correctly.

P. contextum Pers., a somewhat uncommon species, evidently occurs freely in Manners Wood, near Bakewell, where the brilliant orange plasmodium was much in evidence.

Fuligo muscorum A. & S. (=*F. ochracea* Peck.). A mass of the apricot-coloured plasmodium was handed to me by Miss Eyre in Highlow Wood, near Grindleford, and later I gathered more of it, in the same Wood, running over moss and grass. The plasmodium of any species of *Fuligo*, if kept moist and quite protected, rarely forms the natural compact aethalia, but runs either to the "cerebrine" forms or to scattered plasmodiocarps. My plasmodia from Highlow Wood being kept covered up in a tin box did not develop at all well under artificial treatment: the aethalia were very black in colour and of a somewhat sinuous, plasmodiocarp form, so that I judged they must be badly-developed specimens of some *Physarum;* however Miss Lister was able to identify them and was pleased to see the species from Derbyshire, as until this season it had been regarded as quite a rarity in the British Isles. In September Miss Lister found it in almost vast quantities in Epping Forest; about one hundred aethalia were obtained varying from the size of a mustard-seed to great expansions 2 × 1 inch across, also some fine masses of plasmodium, rising from grass, heather and bracken under the shelter of birch and holly-trees: some had crawled eight inches up the holly-twigs to fruit, whilst others formed regularly imbricating aethalia giving the appearance of the pilei of some *stereum*.

This *Fuligo* was also found last September by Miss K. Higgins at Woburn Sands, Beds., where it again attracted the collector's eye in the plasmodium stage; it then has a peculiar tint not quite like that of any other species, and on the two

occasions I have seen it, is very conspicuous in the field as it rises in large masses.

On my return from Baslow, I was fortunate in finding it for the first time in Shropshire, on decaying bracken. It was in the mature form only, which certainly does not so readily catch the eye, especially if it happens to be a little weathered.

Craterium leucocephalum Ditm. was found in great abundance in Yeld Wood at Baslow, on decaying bracken and holly leaves, whilst its usually much more abundant congener *C. pedunculatum* Trent. was nowhere found during the Foray.

Didymium difforme Duby. Only one very small gathering was made of this species, which is usually almost too abundant. In Shropshire it infests heaps of hedge-brushings, rotting stems of umbellifers, decaying thistles, etc., but in the neighbourhood of Baslow it certainly did not appear to be so plentiful, as heaps of rubbish innumerable were turned over in the vain attempt to find it.

Didymium nigripes Fr. with its variety *xanthopus* was unusually abundant in all the woods; some large gatherings were made of this species, and I saw in Sheriff's Wood a specimen of *Armillaria mellea* completely covered by this mycetozoon, which had crept up and fruited all over the stem and pileus of the agaric.

Lepidoderma tigrinum Rost. was found in one spot only in Sheriff's Wood, near Grindleford, where the yellow plasmodium was streaming over moss in a depression in the ground. It is one of the chief prizes on the list, as it appears to be a rare species, there being very few British records of its occurrence.

Stemonitis flavogenita Jahn. is evidently not uncommon in the district, and apparently more in evidence than *S. fusca* Roth., the yellow plasmodium of the former was to be seen in most of the woods.

Comatricha Persoonii Rost. was found in Manners Wood in the plasmodium on leaves (a habitat which *C. obtusata* Preuss. never affects); this gathering matured very nicely, whereas another collection of plasmodium from Sheffield Plantation, evidently the same species, did not fully develop. *C. obtusata* Preuss. was not found in the locality, although the woods were full of fallen oak boughs and sticks, on which it can generally be found.

Lamproderma echinulatum Rost. I gathered this most beautiful species on an old birch log in Sheriff's Wood; quite a large number of sporangia were distributed over the log and the plasmodium must have been of a fair size, as is usually the case also with *L. violaceum* Rost. In the field I judged that it must be this latter species (which I have gathered in Shropshire on several occasions) but the spores proved to be wonder-

fully rough and of a very large size; they exceeded the measurements given in our books, and ran up to 22μ in diameter.

Miss Lister pronounced it to be the finest gathering she had ever seen of this rare species; the previous records are made from Moffat, West of Ireland, and Lyme Regis, as well as from Tasmania and New Zealand.

Cribraria argillacea Pers. and *C. aurantiaca* Schrad. were found in quantities, and apparently intermixed, on most of the old timber in the various saw-yards of the locality. The latter species is very variable. In Shropshire I have usually found it with scattered, almost minute, nut-brown sporangia, whereas these Derbyshire gatherings were of a much more robust and gregarious habit, with long-stalked sporangia. It is evidently impossible to distinguish the plasmodia, as large gatherings of lead-coloured plasmodium were made at Grindleford, some of which developed into *C. argillacea* and some into *C. aurantiaca.*

C. rufescens Pers., a well-defined and much rarer species, was found in Sheriff's Wood under the shade of a rhododendron bush. The sporangia are rather minute and so scattered in habit, growing almost singly, one here and one there, that they are easily overlooked, and it required some little time to make a representative gathering. It is reputed to be a Conifer-loving species but was here growing on very wet moss on a rock beneath the rhododendron. It is not a very common species, probably being often overlooked. Miss Lister has it from Surrey (repeatedly), from Warwickshire and Bedfordshire, as well as from Wales.

In the genus Trichia, *T. varia* Pers. was not very common, whilst *T. affinis* de Bary was handed to me in quantities by various members. *T. botrytis* Pers. was only found once and then in the form distinguished as var. *munda* List. A very common species *T. fallax* Pers. was not recorded at all.

A very fine gathering of *T. scabra* Rost. was forwarded to me, after the Foray, by Mr. Gibbs, I think from Via Gellia, Derbyshire; though reputed to be common I have failed, up to the present, to discover this *Trichia* in Shropshire; and I know it is not common in the neighbouring County of Worcestershire, if it has, indeed, been found there at all.

THE BASES FOR THE SYSTEMATIC DETERMINATION OF SPECIES IN THE GENUS RUSSULA.

By René Maire, D.Sc., &c.

I. Diversity of opinion amongst authors on the subject of the Russulae. The causes of this diversity, and consequent necessity for a methodical description of the species in this genus.

The imperfect knowledge of the species of Russulae is due to the divergent descriptions of the writers on this subject, and this applies equally to the study of the majority of the fleshy fungi, but more especially so to this genus. First the old authors give insufficient descriptions of the species and many modern authors are no better in this respect. It is difficult and impossible to preserve their macroscopic characters by either drying them or immersing them in antiseptic fluids. It is also very difficult to describe correctly or illustrate with sufficient preciseness the fine distinctions observed by the author in a way that will convey his impressions to the reader. The microscopic details, too, are insufficient and would have given us, in many cases, some important characters, if they had been more carefully made. Secondly, the most important cause is the extraordinary uniformity of shape, structure and variations of colour which characterize the genus Russulae. This is so great that it is almost impossible even for a specialist to identify a species in the field, though a careful examination in the laboratory would easily enable him to do so. It is also very difficult to send useful specimens to correspondents because they are often attacked by maggots and after the lapse of a few hours become transformed into a shapeless, putrid mass. In consequence of all these unfavourable conditions and especially the omission by most authors of certain characters (such as the exact tint of the spores, taste, microscopic details, &c.) the systematic mycological works are incumbered with descriptions that do not agree with each other and with figures that cannot be identified. The same species is also described under many different names and one and the same name is given to very distinct species by the various authors. It cannot, however, be denied but that the study of the Russulae has made some progress in the last years of the nineteenth century. The eminent English mycologist

REA told us at Baslow during the session of the *British Mycological Society*, "I recognize pretty often the species described by modern authors but rarely those badly defined by the old authors." We think that opinion is quite accurate and we trust that the present time will realize the saying of Fries* "*Pleniorem dabit lucem futura aetas.*"

In order to accelerate this progress towards the light we must try, first, to make the descriptions comparable; secondly, to find specific characters that can be easily defined; and, thirdly, to record characters as much as possible that are capable of observation in dried specimens, so that it may be possible to control a determination made with the help of a description and of a drawing by comparing it with the type specimen. I have studied the Russulae deeply for some years and I can now formulate a method for the systematic study of the species of this genus. I make use of all the characters hitherto employed and I have added new ones. The application of this method to all the species that I could obtain either during my mycological excursions in France, Sweden and England, or by the assistance of obliging correspondents† enables me to control the value of the different characters that I have used so that I could in many cases satisfy the above desiderata. Before the publication of a Monograph on the European Russulae which I have undertaken I thought it would be useful to give to mycologists an exposition of my system with some examples of its application. I do not propose to give an exhaustive list of all the characters which can be used in the description of the Russulae. The future will certainly add new ones, especially microchemical ones, which will enable us to determine more easily the distinctive characters. I think, however, in the actual state of our knowledge that it is already possible having regard to these characters, which I will explain further on, to establish some reliable posts in the quicksands of the Russulae and to define certain types which can be recognized without being obliged to resort to tradition.

II. Outlines of my methods for the systematic study of the Russulae.—Critical study of the characters.

My method for the systematic study of the Russulae requires three series of observations: First, their macroscopic characters; secondly, their microscopic characters; and thirdly, their chemical reactions. My method is therefore divided into these three parts.

*FRIES, Hymenomycetes Europaei, Upsaliae, 1874, p. 2 (preface).

† I have mnch pleasure in giving here a thousand thanks to those correspondents in general and particularly to M.M. ARNOULD, BRESADOLA, DUPAIN, HADOT, PELTEREAU, Raoult.

A. THE MACROSCOPIC EXAMINATION OF THE RUSSULAE.

If we examine a Russula with the naked eye or with a pocket lens we are able to study: first its general appearance, secondly the characters of the stem, thirdly the characters of the pileus, and fourthly the characters of the gill. Before passing to these characters in detail we must remember that a Russula is only an organ of fructification, a *carpophore*, and therefore that it would be well to study its mycelium also. But this study, both macroscopic and microscopic, is very difficult and up to the present has not yielded any useful results. Cultures in artificial media will perhaps furnish in the future interesting characters. I shall content myself now with a study of the carpophore.

I. General Characters of the Carpophore.

The general characters of the carpophore are its size, consistency, taste, smell, the general colour of the flesh and its change of colour, and the colour of the spores *in mass* (*Sporenpulver* of the Germans).

Size. This is measured by the diameter of the pileus, it is often variable and should not be neglected, but it must be used with caution. There are some species which are normally very large, although occasionally some smaller specimens are found, and I cite as examples *R. alutacea* Fr. where the pileus attains 20 cm. in diameter and rarely descends to 8 cm., *R. foetens* Fr., *R. cyanoxantha* Fr., &c. Others on the contrary are generally of small size and thin, and it is only rarely that one meets with some larger specimens. I cite as examples *R. chamaeleontina* Fr., which rarely exceeds 6 cm. in diameter, *R. nauseosa* Fr., *R. Turci* Bres., *R. lutea* Fr., &c. Between these two extreme types we find a middle one as exemplified in *R. heterophylla* Fr., *R. fellea* Fr., *R. emetica* Fr., *R. drimeia* Cke., *R. Queletii* Fr. &c. It is therefore advisable to indicate as far as possible the maximum and minimum dimensions of the pileus, and when these are aberrant to indicate the normal one. It is sufficient in the field to designate them as large, medium sized or small, because it is a point of not much importance.

Consistency. This is almost always the same. Firm and close in texture in young specimens becoming more or less loose and fragile in mature specimens. It has, however, some differences rather quantitative than qualitative that are very marked in some species. These characters were used by Fries in conjunction with other characters for establishing his sections of this genus the *Compactae*, *Rigidae*, *Firmae* and *Fragiles*, and I cite as characteristic examples of the *Compactae* *R. delica* Fr., *R. nigricans* Fr. which remain hard and firm until old age, *R. chamaeleontina* Fr., *R. lutea* Fr. and some neighbour-

ing species which are on the contrary soon loose and fragile, *R. subfoetens* Sm. quite firm and elastic, *R. lepida* Fr. and *R. virescens* Fr. firm until quite old. In *R. cyanoxantha* Fr. the pileus is slightly elastic and the gills are both elastic and oily "lardacée"* Forquignon. The consistency is generally pretty constant in one and the same species but sometimes it varies in some specimens: thus certain forms of *R. melliolens* Quél. are firm and close in texture, whilst others of the same age are much more fragile and loose in texture. On the other hand consistency is a character difficult to define clearly and precisely, it may be used for the identification of a species well known, but one cannot rely on it alone for determination.

Taste. The taste is an important character that should always be noticed amongst the fungi and especially in the Russulae. It is either mild, bitter or acrid. The acridity of the Russulae seems to be due to the presence in more or less quantities of certain resinous bodies in the tissues which are not well known and seem to be confined to the lacticiferous vessels and cystidia. These bodies are unstable and change or decompose easily either by the action of heat or oxydation. Thus the most acrid Russulae lose their pungency when either cooked or dried or ground up in a mortar and treated with hydrogen peroxyde (H_2 O_2).† The acridity is perceived either almost immediately or slowly, it is more or less intense in different species. In addition to the characteristic tingling or burning of the tongue there is sometimes added a sensation of constriction in the region of the pharynx. I will now give some differences in their acridity. In *Russula grisea* Bres. the acridity is very slight and is confined to the young gills; *R. aeruginea Lindbl.* is a little more acrid and the acridity is not confined to the gills but is also perceptible in the flesh of young specimens. *R. fragilis* Fr. is distinctly acrid in all its stages but the acridity is not very persistent. *R. drimeia* Cke., and especially *R. emetica* Fr. and *R. sardonia* Bres. (non Fr.) have an intolerable and persistent acridity and the two last species particularly cause a constriction of the pharynx. In *R. fragilis* Fr. and *R. drimeia* Cke. the acridity is immediately perceived, whilst in *R. maculata* Quél. and *R. sardonia* Bres. (non Fr.) it is only felt after the lapse of some little time. In all the species the acridity diminishes with age until it entirely disappears in those species where it is only slight as in *R. grisea* Bres., *R. aeruginea* Lindbl., *R. decolorans* Fr., *R. atropurpurea* Krombh., *R. paludosa* Britz., &c. The acridity attains its maximum of intensity most often in the gills.

*From lard (=bacon).

† The consequence of grinding up was first noticed by Boudier in the case of *R. fragilis* Fr. and I have verified it with that species and also with *R. sanguinea* Fr.

The mild taste, which is very frequent and common in all those species that are generally eaten, has sometimes an agreeable smell and the gills of *R. heterophylla* Fr. often have a distinct savour of walnut. The bitterness is much rarer and the bodies that produce it are still quite unknown. It distinctly characterizes *R. lepida* Fr. var. *amara* Maire. Some species have a mild taste at first and then become slightly bitter or sharp and somewhat astringent; such are *R. lepida* Fr. and especially *R. pseudo-integra* Arn. & Goris. PERSOON and FRIES considered that the taste was a very variable character, whereas ROMELL on the contrary maintains that it is a very constant one. The truth lies between these two opinons. Amongst the majority of species the taste is certainly remarkably constant. I have never found specimens of *R. virescens* Fr., *cyanoxantha* Fr., *punctata* Gill. and *xerampelina* Fr. that were not mild; and further I have never noticed the acridity absent in *R. drimeia* Cke., *emetica* Fr., *fragilis* Fr., *fellea* Fr., &c. But in some species otherwise well characterized the taste is evidently variable. Here are some examples. COOKE (1888) noticed that *R. atropurpurea* Krombh. is sometimes mild but more often acrid, and I have confirmed him as to this. *R. melliolens* Quél., a species quite mild, has a very rare variety *R. melliolens* Quél. var. *Chrismantiae* Maire which possesses all the characters of the type, especially the characteristic spores, and it differs only in the decidedly acrid taste of the mature plant. Again *R. lepida* Fr. is at first mild then slightly biting and has a variety intensely bitter and somewhat different in colour, *R. lepida* Fr. var. *amara* Maire. *R. paludosa* Britz. is mild in all its stages in the Vosges but is distinctly acrid when young in Sweden; *R. grisea* Bres. is generally a little acrid in the gills but sometimes it is entirely mild.

Smell. Smell is a character very difficult to define and like consistency is more useful for the recognition of a species than for its first determination. Very often it is possible to define a smell only by a more or less close comparison with some odorous substance, for it is but very rarely that the odour is produced by a definite chemical compound that can serve as a standard. Every mycologist, however inexperienced, can call to mind the odours given out by the fungi that they have studied, and easily recognise them. Most authors have however paid little attention to the smell of the Russulae and only a few like QUÉLET, ROMELL, &c., have accorded to them the importance that they deserve. In the majority of the Russulae the smell is faint and of no account; but in others on the contrary, it is very characteristic. Thus *R. melliolens* Quél. when it begins to dry or rot acquires a strong smell of honey or gingerbread, and this is why it is so named. This

smell persists for many weeks in dried specimens. Some other Russulae, especially *R. flava* Romell, have the same smell but not so intense and constant. *R. Turci* Bres., *R. punctata* Gill. and *R. foetens* Fr., have each a distinctive smell more or less intense in different specimens, hard to define but easily recognisable when one is acquainted with it. *R. maculata* Quél. has a smell closely resembling that of *Rosa rubiginosa* L.; *R. fragilis* Fr., *R sardonia* Bres. and *R. emetica* Fr. have all the same indefinable aromatic smell but easily recognisable. *R. xerampelina* Fr. (=*R. graveolens* Romell. =*R. vesca* Massee) has a characteristic smell, like that of the common crab, but this is only apparent in old specimens or when they have been cooked. *R. lepida* Fr. has when cooked a peculiar nitrous smell, due to a body that permeates the organism without becoming decomposed, the odour of this body is also found in the urine after eating this Russula. The smell is not always constant: COOKE has pointed out that *R. foetens* Fr., which is generally characterized by a very strong and distinct smell, can sometimes be found without any.

General colour of the flesh and its change of colour. The flesh of the Russulae is usually white. However in *R. aurata* Fr. and *R. drimeia* Cke. it is very often coloured citrine-yellow, in *R. ravida* Fr. bluish grey, and in *R. ochracea* Fr. ochre. A certain number of species moreover are distinguished by the characteristic change in colour of their flesh. On exposure to the air after a wound the flesh of *R. nigricans* Fr. and *R. densifolia* Gill. quickly turns red and then finally black; that of *R. adusta* Fr. changes directly to black under the same conditions. This blackening has been studied in its chemical aspect by BERTRAND (1896). This author has stated that it was due to an oxydizing enzyme, tyrosinase, which reacts in the presence of the oxygen of the atmosphere on the tyrosine contained in the cell sap of the fungus. *R. decolorans* Fr., *obscura* Romell and *flava* Romell become black more or less completely and rapidly on exposure to the air. *R. sardonia* Bres. (non Fr.) (=*R. luteotacta* Rea) turns yellow especially in the gills when wounded or dried up. This turning yellow however is not constant and is sometimes absent. A similar though less intense change to yellow is often observed in the gills of *R. sanguinea* Fr. var. *pseudorosacea* Maire. The flesh of *R. xerampelina* Fr. is spotted with brown more or less rapidly on exposure to the air and becomes entirely brown when cooked or dried and this last factor makes it easily recognisable in the herbarium. A rusty-brown colour can be observed on the gills of old specimens in many species but this browning is generally confined to more or less numerous and extensive spots; and it is moreover inconstant (*R. heterophylla* Fr. and *R. aeruginea* Lindbl.). In *R.*

melliolens Quél. this change to brown is constant and becomes general in old age.

Colour of the spores in mass. This character is *very important and very constant*, but it is necessary that it should be observed in a careful manner, which few authors have done, except ROMELL and BRITZELMAYR. *The study of the colour of the spores seen with the aid of the microscope cannot in any way replace that of their exact tint when they are viewed in mass.* This ought to be determined by *obtaining a deposit of the spores in sufficient quantity on white paper.* It is therefore necessary to try and obtain a deposit of the spores of all the Russulae studied, and if anybody sends a Russula to a correspondent they should enclose such a deposit as it is often very difficult to obtain one after it has travelled. Deposits on a slip of glass are useless because the reflection prevents the appreciation of pale tints; neither should the deposits be obtained on black paper, so useful in many other cases, as the pale tints readily appear white. Further the *spore deposit should not be fixed to the paper by gum or varnish* according to HERPELL'S (1880) method, because these agents materially alter the tint of the spores. We must then be content, when we wish to send or preserve a spore deposit, to fold up the paper in a manner that will protect it. The spore deposit (map) thus obtained will last for some weeks or months but changes tint with age and becomes deeper in colour; their shade of colour ought then to be studied when quite fresh and in daylight. By working in the way indicated we find that certain Russulae, few in number, have pure white spores. Others, much more numerous, have more or less coloured spores varying from very pale whitish cream to deep yellow ochre. The principal shades of colour may be approximately referred to the tints *stramineus*, *cremeus*, *ochroleucus* and *ochraceus* of Saccardo's Chromotaxia.* The following examples will readily show the utility of noting the spore colour of the Russulae, *R. violacea* Quél. so akin to *R. fragilis* Fr. and especially to *R. fallax* Cke. is easily distinguished by the whitish yellow *(stramineus)* spores, whilst the others have pure white spores. *R. alutacea* Fr. is easily distinguished from *R. xerampelina* Fr. by its yellow ochraceous *(ochraceus)* spores, whilst those of *R. xerampelina* Fr. are much lighter in colour *(ochroleucus)*. I append here a list drawn up from my notes in alphabetical sequence of the species with purely white spores (Leucosporae) and of those with more or less coloured spores (Xanthosporae).

*The two copies of this work that I can consult contain very great differences in the shades of colour. The first edition appeared in 1891 and the second edition in 1894. The tints quoted above are for *stramineus* and *ochraceus* from the second edition; those for *cremeus* and *ochroleucus* from the first edition.

We notice that many species which the authors thought possessed white spores in reality have yellow spores. I have omitted from this list those species which I have been unable to study myself when fresh.

RUSSULAE LEUCOSPORAE.

R. adusta Fr., *atropurpurea* Krombh., *azurea* Bres., *carnicolor* Bres., *cyanoxantha* Fr., *delica* Fr., *densifolia* Gill., *depallens* R. Fr. (an E. Fr.?), *emetica* Fr., *fallax* Cke. (an Fr.?), *fragilis* Fr., *heterophylla* Fr. (incl. *vesca* Fr. sensu Bres. et Romell), *lilacea* Quél., *nigricans* Fr., *sardonia* Bres. non Fr., *subfoetens* Sm.

RUSSULAE XANTHOSPORAE.

R. aeruginea Lindbl., *alutacea* Fr., *aurata* Fr., *badia* Quél., *caerulea* Cke. (an Fr.?), *chamaeleontina* Fr. (with var. *armeniaca* Cke. and *minutalis* Britz.), *consobrina* Fr., *cutifracta* Cke., *decolorans* Fr., *drimeia* Cke., *fellea* Fr.,* *flava* Romell, *foetens* Fr., *fusca* Quél., *grisea* Bres., *insignis* Quél., *integra* Fr., *lepida* Fr., *lutea* Fr., *maculata* Quél., *melliolens* Quél., *nauseosa* Fr., *obscura* Romell, *paludosa* Britz., *Postii* Romell, *pseudo-integra* Arn. et Goris, *puellaris* Fr., *punctata* Gill. (=*amoena* Quél.), *Queletii* Fr., *Romellii* Maire (=*integra* Quél. pro parte, non Fr.), *rosea* Quél., *roseipes* Bres., *rubicunda* Quél., *rubra* Fr. (non Quél. nec Cke.), *sanguinea* Fr., *sororia* Fr., *urens* Romell, *Turci* Bres., *veternosa* Quél., *violacea* Quél., *virescens* Fr., *vitellina* Fr., *xerampelina* Fr.

2. CHARACTERS OF THE STEM.

In the stem we have to consider its shape, size, the form and colour of its cuticle and its internal structure.

Shape.—The shape of the stem varies very little in the Russulae. This portion of the carpophore is always cylindrical or subcylindrical. In almost all the species some of the specimens are larger either at the base, or the middle or the apex of the stem so that they appear more or less bulbous, spindle-shaped or obconic. But these are unimportant and inconstant variations.

Size.—The size of the stem corresponds to the dimensions of the pileus in the Russulae and offers only some unimportant variations which are generally due to the conditions under which the fungus is developed. Thus *R. paludosa* Britz. has a very long stem when growing amidst thick tufts of mosses (hence its synonym *R. elatior* Lindbl.) but its stem is normal when it is found in habitats with scarcely any moss.

*The spores are so pale in this species that it is doubtful whether it should not be placed amongst the leucosporae.

Form and colour of the cuticle.—The stem of the Russulae is covered with a pellicle that is generally loose, extremely thin and white, and is, especially when young, more or less pruinose or mealy to the naked eye or with the aid of a pocket lens. This pruinose condition diminishes and disappears with age in most of the species except at the apex of the stem close to the gills, where it persists for a long time. Consequently the stem in mature specimens of Russulae is generally glabrous, white and more or less wrinkled, because the cuticle is too thin and does not conceal sufficiently the longitudinal bundles of the flesh beneath it. There are, however, some species which pretty constantly depart from this rule and are therefore worthy of note. Thus in *R. drimeia* Cke., *R. Queletii* Fr., and *R. rubra* Fr. the cuticle is coloured (purple or purplish-violet) is thicker and is more pruinose than the general rule. The stem in these species is in consequence generally smooth, mealy and coloured until old age. Some forms of *R. Queletii* Fr. are found that have the cuticle of the stem less developed, the stem is then sometimes white, glabrous and wrinkled-striate, and the majority of the specimens come to this condition. In *R. alutacea* Fr. and *punctata* Gill. the stem also has a pretty thick cuticle and is often coloured purple. In the first of these two species it often cracks at maturity and thus gives to the surface of the stem a stippled appearance, and we observe this also sometimes in *R. rubra* Fr. Some other species have a more or less coloured stem but it is rarely constant. I cite *R. lepida* Fr. with a stem almost always red or tinted with red; *R. consobrina* Fr. with an olive coloured stem; *R. roseipes* Bres., *R. paludosa* Britz., *R. xerampelina* Fr. with stem normally rose coloured; *R. aurata* Fr. generally with a yellow stem; *R. cyanoxantha* Fr. and *R. emetica* Fr. with stems rarely washed with rose, &c. The flesh of the stem immediately below the cuticle is generally white, sometimes it is concolorous with the cuticle for a little distance (*R. Queletii* Fr., *R. drimeia* Cke., and *R. sanguinea* Fr. &c.) and rarely is it of another colour as in *R. subfoetens* Sm., where it is often yellow.

Internal structure. The stems of the Russulae are generally solid, firm and almost homogeneous when young, at maturity the flesh on the outside continues firm and dense, whilst that of the inside generally becomes more or less loose or else hollow. The mature stem then is either solid or hollow. In the former case the internal flesh is relatively firm or more or less spongy; sometimes it is lacunose, and this leads up to the hollow stem, which is pretty rare. When the external firm flesh passes more or less abruptly into the spongy flesh of the interior, then the stem becomes more or less distinctly corticate. Many of these variations are met with pretty frequently in the same

species, and for this reason the internal structure of the stem is often of very little use for the determination of species and moreover very frequently the interior of the mature stem cannot be observed because of the destructive action of larvae. Some species, however, vary less from this point of view. Such are for example *R. delica* Fr., *R. nigricans* Fr., *R. rubra* Fr., and *R. lepida* Fr., where the stems keep firm until extreme old age; *R. pseudo-integra* Arn. & Goris where the stem is quite spongy when young; *R. chamaeleontina* Fr. and *R. lutea* Fr. where the stems become hollow at an early stage.

Characters of the Pileus.

Besides the gills, which we shall study separately, the pileus of the Russulae presents for our consideration its general shape, size, margin, cuticle and the colour of the flesh below the cuticle.

General shape. The general shape of the pileus is very similar in all the Russulae. Subglobose then hemispherical when young, the pileus opens out more and more and becomes generally depressed in the centre so that at maturity it is more often convex or convexo-plane with the centre more or less depressed. In Fries' *Compactae* section of the Russulae the margin of the pileus is never completely spread out. In the other species, on the contrary, the margin is often turned up at maturity and the fungus then becomes more or less infundibuliform or cup shaped. One Russula is characterized by the shape of its pileus, this is *R. caerulea* Cke. which has a distinct and constant umbo to the pileus and this immediately distinguishes this species. Some other species of Russula are accidentally umbonate, as for example *R. Queletii* Fr., but then the umbo is generally indistinct and inconstant.

Size. I will not discuss here the average diameter of the pileus. Its thickness is generally pretty considerable at least in the centre. Towards the margin the thickness is very variable and often furnishes valuable characters for its determination.

Margin. When the thickness of the pileus gradually diminishes from the centre towards the somewhat thick edge, then the margin is opaque and smooth, and we cannot perceive the upper anterior ends of the gills. This characterizes all the species belonging to the Friesian section *Compactae*, such as *R. delica* Fr. and *R. nigricans* Fr. In the species placed in the sections *Firmae* and *Rigidae* by the same author, the pileus becomes somewhat abruptly thinner towards the margin and in old specimens some more or less distinct striations are apparent at the edge (*R. Queletii* Fr., *R. cyanoxantha* Fr. &c.). In the *Fragiles* section this thinning out towards the margin is much more pronounced, and it often begins abruptly at a considerable

distance away from it; in consequence of this the margin becomes translucid and distinctly striate for a considerable width, and we can easily distinguish the anterior part of the gills. Many of the striations become furrows because the feeble and slow intercallary growth of the gills does not keep up with the rapid expansion of the pileus. The margin now exhibits a series of ribs which are often mixed with tubercles. These tubercles are situate on the inter-laminar veins which have impeded the expansion of the pileus. I cite as examples of species distinctly striate at the margin: *R. fragilis* Fr., *R. chamaeleontina* Fr. and *R. puellaris* Fr. The furrows and the tubercles are especially noticeable in *R. foetens* Fr., *R. elegans* Bres., &c. All these characters of the margin are very constant in some species, as in *R. foetens* Fr., much less so in some others as in *R. integra* Fr. and *R. Romellii* Maire, where the margin appears to be almost smooth, striate or furrowed and tuberculose according to the individual specimens. The involute margin at maturity of FRIES' section the *Compactae* is also a distinctive character. Other characters are provided by the margin, on a section of the fungus, which depend upon the shape of the gills, but I will direct your attention to this under another head.

Cuticle of the pileus.—The pileus is covered by a distinct pellicle, often called the cuticle, which gives it a particular colour and also some other important characters. The colour of the cuticle may certainly vary but within much more restricted limits than FRIES thought. In some species the colour is nearly constant if we allow for the variation of its intensity due to the action of light, rain, age, &c. I quote as examples *R. foetens* Pers., *R. subfoetens* Sm., *R. consobrina* Fr., *R. aeruginea* Lindbl., &c. In other species on the other hand where we have two pigments present, the one purple or violet and the other olive-green, the shade of colour varies very much owing to the distribution and proportions of these pigments; (*R. alutacea* Fr., *R. xerampelina* Fr., *R. Turci* Bres., *R. cutifracta* Cke., &c.). The entire absence of one of the usual pigments makes certain species almost unrecognisable. This occurs in *R. punctata* Gill. and especially in *R. drimeia* Cke. This last species is generally purple-violet without any apparent mixture of colours, but sometimes specimens of it are found of a greenish-yellow and it then becomes *R. flavo-virens* Bomm. & Rouss. The red and green species with only one pigment do not generally vary except from white up to their deepest colour; as in *R. fragilis* Fr. and *R. virescens* Fr. It is therefore necessary to include in the description the colour of the cuticle and to indicate as clearly as possible its variations. We ought also to pay great attention to the surface of the cuticle. This is more or less viscid in most of the species. The observation of this viscidity

should be carefully made; many viscid species in times of drought appear to have an absolutely dry and pulverulent cuticle. This change of appearance is very clearly seen in *R. alutacea* Fr. and *R. Turci* Bres. I have observed specimens of these species half covered with leaves after a storm of rain following on a period of fine weather. The covered parts retained their dryness and were pulverulent whilst the moistened portion had become completely viscid. It is better therefore before we declare that the cuticle is dry or viscid to wet it when gathered during a dry time. If we take these precautions we find that the greater number of the Russulae are viscid whilst some are always dry, a very important character for their accurate determination. These latter include *R. lepida* Fr., *virescens* Pers., *punctata* Gill., &c. BATAILLE bases his group *Siccae* on this important character but he includes also some species that are distinctly viscid in wet weather, such as *R. cutifracta*. When the cuticle is dry it is either dull or shiny. It is generally dull in the species that are not viscid, and more or less shiny in the majority of those that are viscid, but this does not apply to them all. These characters should be noted when they are clearly seen. In *R. grisea* Bres. the cuticle is very shiny when dry, whereas it is quite dull in *R. alutacea* Fr., *R. xerampelina* Fr., and *R. Turci* Bres. The dry or viscid cuticle is sometimes more or less cracked on the surface. These cracks are nearly constant in *R. virescens* Fr., but on the other hand they are accidental although frequent in *R. cutifracta* Cke., *carnicolor* Bres. and *grisea* Bres. In the first case where the cuticle is dry and thick the exterior portion has completed its development earlier and cannot keep up with the expansion of the underlying tissues. In the second case, on the other hand, the cuticle is thin and viscid and the cracks are only produced when they become incapable of stretching before the fungus opens out in consequence of dryness. The cracks of the first type are therefore only of importance to the systematist. Lastly the cuticle may be more or less separable from the underlying flesh. When the pileus will not peel the cuticle is said to be *adnate*, and when it does so it is termed *separable* or pelliculose. It is still a useful character in some cases although it varies considerably in the majority of species. In a great number of the Russulae the cuticle is adnate at the centre of the pileus but is more or less separable towards the margin. The extent of this separable zone varies in a greater or less degree in the different species and often in different specimens of the same species. Some species however have the cuticle completely separable or scarcely adnate in the middle, such as *R. fragilis* Fr., *R. chamaeleontina* Fr., *R. paludosa* Britz., &c. Other species have the cuticle entirely adnate, as *R. lepida* Fr., *R.*

virescens Fr., *R. punctata* Gill., *R. delica* Fr., *R. nigricans* Fr., &c. Generally the dry species have the completely adnate cuticle, but the viscid species become difficult to peel when they are dried.

Colour of the flesh under the cuticle. The flesh under the cuticle is either white or coloured, and this we ascertain by either peeling the fungus or by making a radial section of it. This character is often variable and depends on the depth to which the pigment extends, and which attains its maximum in the cuticle, but it is sometimes of great service in distinguishing some species where it is pretty constant. Thus *R. cutifracta* Cke., which greatly resembles *R. grisea* Bres., is distinguished by its violet coloured flesh under the cuticle of the pileus.

CHARACTERS OF THE GILL.

The gills ought to be studied individually and collectively. Individually a gill offers for our consideration its colour, general shape, width, thickness, edge, insertion and tear-like drops.* Collectively the gills lead to the study of their relation to one another their equality or inequality, either forked or connate, their spacing and intervenation.

Colour of the gills. The colour of the gills is an important character which should be carefully studied. It may be due either to the colour of the hymenium itself or to the colour of the spores that it bears or to a combination of both of them. In the three cases, but especially in the two last, they frequently differ very greatly with age. Thus in *R. Turci* Bres. the gills are at first pale sulphur yellow, then they become ochre after the spores have appeared; the yellow gills of *R. xerampelina* Fr., *R. integra* Fr., and *R. Romellii* Maire are white when young and at maturity are covered with an ochre-cream dust. In *R. alutacea* Fr. the gills are at first whitish and become cream coloured from the colour of the hymenium and then ochre-cream after the appearance of the spores. The yellow citrine colour of the gills of *R. aurata* Fr. and the beryl colour of those of *R. delica* Fr. var. *glaucophylla* Quél. are due to the colour of the hymenium itself; although the orange-ochre colour of those of *R. chamaeleontina* Fr. arises from a combination of the colours of the hymenium and of the spores. The edge of the gills sometimes appear specially coloured, it is so very often in *R. aurata* Fr. and *R. delica* Fr. var *glaucophylla* Quél., where the citrine or beryl colour is confined to the edge and its vicinity. The edge of the gill of *R. punctata* Gill. is often purple-violet or

*The gills are pretty frequently covered when young with drops of water: they are then said to be weeping.

purplish. On the other hand certain Russulae frequently have the cuticle of the pileus decurrent on the edge of the gills, which then become coloured like the pileus for a variable length. This feature is present in a great number of species, as for example in *R. lepida* Fr., *R. alutacea* Fr., *R. paludosa* Britz., *melliolens* Quél., &c.; but it is nowhere constant.

General shape of the gills. In order to ascertain the general shape of the gills one must make a radial section of the pileus. We find that in the greater number of species the shape of the gills is practically the same as BARBIER (1907) has well said. "In many of the Russulae before the pileus has either completely opened out or has become hollowed out the gills have almost the shape of separate petals or flies' wings; they gradually decrease from the margin (in front) towards the stem (behind) until they terminate in a point on that side; the edge* leaves the stem at a right angle and abruptly forms a semi-circle at the margin of the pileus where the gill reaches its greatest width." There are, however, some more or less constant variations; in the young state the edge is generally quite straight and a little arched later on it often becomes ventricose; the base is less abruptly arched at the anterior end at maturity and can also become almost completely straight when the pileus is fully opened out. In FRIES' *Compactae* section, however, of the Russulae the shape of the gills departs from this general type in the young state they are attenuated at both ends and the edge is parallel with the base or more or less ventricose. In *R. sanguinea* Fr. the gills are soon attenuated in front but in young specimens they are of the normal shape. In many other species we observe a similar early attenuation of the gills in front which causes the pileus to have an acute margin, and I cite as examples *R. cyanoxantha* Fr., *R. heterophylla* Fr., *R. fellea* Fr., *R. foetens* Fr., *R. subfoetens* Sm., *R. Queletii* Fr., *R. drimeia* Cke., &c. The gills in the Russulae on the other hand preserve their typical shape up to maturity and their rounded anterior end makes the margin of the pileus very obtuse. This character is clearly ~~marked~~ in most of the species belonging to the Friesian ~~sections~~ *Fragiles* and *Rigidae*. It must be noticed, however, that this difference in shape of the gills in the mature fungus very frequently varies and we find every transition in the species well characterized from this point of view and one can also often observe it in the same species.

Width of the gills. This character also is very variable in the Russulae when compared at the same age. There are, however, some species where the gills are constantly narrow, as

* It should be added "and the base."

R. foetens Fr., *R. subfoetens* Sm., *R. sanguinea* Fr., *R. drimeia* Cke., *R. heterophylla* Fr., and *R. delica* Fr. The breadth of the gills should be numerically given in the description. In the majority of cases, however, the variability and small importance of this character makes these measurements almost useless to the systematist, whilst in others the exact measurements would be of great service.

Thickness of the gills. The thickness of the gills varies very much, and their precise measurements would not be of sufficient utility in comparison with the loss of time given to it by the describer. It is sufficient in my opinion to indicate that in such and such a species the mature gills are exceptionally thick as in *Russula nigricans* Fr., *R. alutacea* Fr., and *R. Turci* Bres., or on the contrary that they are particularly thin, as in *R. heterophylla* Fr., *R. chamaeleontina* Fr., *R. lutea* Fr., &c.

Edge of the gills. I have mentioned above the colour of the edge of the gills in certain species and I will not repeat it. I further note that the edge is sometimes more or less floccose. This is a very rare character amongst the Russulae and is met with only in *R. pseudo-integra* Arn. & Goris and *R. punctata* Gill., and it is not always very pronounced.

Insertion of the gills. As BARBIER (1907) said, the shape of the stem, often a little widened at the summit, together with the variable attenuation of the gills, takes away much of the value that is to be attributed to their insertion. This insertion from the first varies with age, and FRIES (1836), in order to avoid this source of error, studied it when the pileus was still unexpanded. But still, under these conditions, we find that in the majority of species the insertion of the gills is not constant. Generally the gills are free or very slightly adnate, and we can find these forms of insertion on the same specimen. At maturity many of the species have their gills very slightly sinuate at their insertion on the stem. There are, however, some species which are distinguished by their gills being constantly adnate at every stage, such are *R. adusta* Fr., *R. subfoetens* Sm., *R. delica* Fr., and *R. sanguinea* Fr. In these two last the gills become also decurrent at maturity. But the slight taxonomic importance of this character is proved in the Russulae, because in *R. Queletii* Fr. and *R. drimeia* Cke., two species incontestably nearly related to *R. sanguinea* Fr., the adnate gills have no constancy.

Tear-like drops. This character is pretty frequent amongst the Russulae and ought to be noticed when observed, but it depends greatly on the meteorological conditions, to which it would be imprudent to attach too much importance. It is especially noticeable and constant in *R. delica* Fr.

Equality or inequality of the gills. In the majority of the

Agarics we find the gills of varying lengths. Some extend from the margin of the pileus to the stem whilst others are arrested at a more or less considerable distance from the margin. We call these last *lamellulae.* Generally gills and lamellulae of different sizes alternate pretty regularly. It is rarely so in the Russulae: the great majority of them have lamellulae only interspersed here and there without any order and often few in number; it is the same in species where numerous specimens do not possess a single lamellula (*R. chamaeleontina* Fr., *lutea* Fr., &c.). It is in the section *Fragiles* of *Fries* that the lamellulae are reduced to their minimum. In the *Compactae* section on the other hand we find the lamellulae alternating with the gills almost as regularly as in other Agarics. In the *Compactae* therefore the inequality of the gills is an important character, whilst in the other sections it is extremely variable from one species to another and also in the same species, with the result that it is scarcely of any importance. Thus *R. fragilis* Fr., which generally has its gills all equal, often furnishes specimens with pretty numerous lamellulae. And *R. cyanoxantha* Fr. has either numerous lamellulae or scarcely any.

Furcate and connate gills. It often happens, especially in species with pretty numerous lamellulae, that many of them become joined to the neighbouring gill. This joining also occurs between gills themselves at equal or unequal heights and in the former case gives origin to forked gills. The forking may occur at a more or less considerable distance from the margin of the pileus; when it proceeds from the level of the insertion of the gills upon the stem, then it is called *connate:* it has no connection with the furcation of gills and lamellulae but with that of two gills alone. The gills are forked or connate more frequently in certain species, as in *R. cyanoxantha* Fr., *R. foetens* Fr., and *R. aeruginea* Lindbl., they are also found more or less distinctly amongst almost all the Russulae with the exception of those included in the *Compactae* section and perhaps some few in the *Fragiles* section. It is then not necessary to exaggerate the importance of this character as FRIES did when he changed his section *Firmae* into *Furcatae.*

Spacing of the gills. The spacing of the gill varies much with age, it should therefore be always noted at maturity, at the time when the spores commence to appear and when the pileus has opened out without being deformed. In these conditions we can observe pretty clearly the spacing of the gills in some species. Thus in *R. nigricans* Fr. the gills are very distant, whilst in *R. adusta* Fr. the gills are crowded; so also in *R. heterophylla* Fr. the gills are more crowded than in its neighbour *R. cyanoxantha* Fr. Apart from these species the differ-

ence of spacing of the gills is of little value and the individual variations exceed the specific. The exact record of this character is very difficult* and the spacing of the gills is practicably a negligible quantity except in the case where it is very striking.

B. MICROSCOPIC EXAMINATION OF THE RUSSULAE.

We can study a Russula with the microscope and investigate the flesh, the cuticle of the stem and of the pileus, the gills and the spores. The structure of the flesh is very constant in the Russulae. It consists chiefly: First of bodies that are either subcylindrical and simple or branched in the stem, or ellipsoid and round in the pileus, and of large round cells, termed *sphaerocysts*, which in a transverse section appear to be arranged in a rosette, generally around a central hypha; secondly of elongated hyphae similar to those in other Agarics, which fill up the interstices between the mass of *sphaerocysts*. More or less numerous lacticiferous vessels (FAYOD'S oleiferous hyphae) occur amongst the elongated hyphae, especially in certain regions. The variations in this structure are of little importance; they depend chiefly on the frequency of the lacticiferous vessels and the more or less distinct separation of the mass of sphaerocysts in the pileus. Again it is necessary to compare specimens of the same age, because variations of the same nature occur in the same specimen during the course of its development. The variations in structure of the flesh are then practically of very little use to the systematist. I will study more deeply the gills, the cuticle and the spores. The study of these can be combined with that of the gills and here is a way of proceeding to a complete and rapid investigation. We prepare three glass slips, on the one we place a drop of water on the second a drop of sulpho-vanillic reagent, and on the third a drop of sulpho-formolic reagent. These two last will serve for our microchemical studies, which I shall speak about further on. We then under a dissecting microscope and with the aid of a very sharp scalpel, make transverse sections as thin as possible of the gill, the cuticle of the pileus and the exterior portion and cuticle of the stem. The transverse sections of the gill ought to include the edge, they are very easy to make, and this is the case also with the stem. The sections of the cuticle of the pileus are difficult to make, especially when it is viscid and

* To obtain it we should have to count the number of the gills and to measure the size of the pileus; this would necessitate numerous measurements and calculations without any sufficient precision being arrived at, because slight differences in age would be sufficient to cause a change and to conceal such feeble specific variations. Photography is certainly the best agent for recording the spacing of the gills in those species where it is characteristic.

separable; but after a little practice we are able to obtain satisfactory sections. We place all these sections in a drop of water. It is also advisable to add a small bit of the cuticle of the pileus carefully skinned off when it is separable or obtained by a superficial cut when it is adnate and a small piece of the cuticle of the stem should be procured in the same way. Certain species have the cystidia in their cuticles so distant that they may escape observation in the transverse sections only. We deal in the same way with the other sections and bits of the cuticle by placing them in the drops containing the reagents on the glass slips, and we cover all of them with cover-glasses. If we are obliged to study dried specimens, which should only be done *in default* of fresh ones, then we can very easily make satisfactory sections with a razor of the dried material kept in position by elder pith. The sections are next boiled either in GUEGUEN'S reagent* (1906) or in AMANN'S lactophenol** (1896) when we do not wish to stain them. On the other hand if we desire to stain them, then we place the sections on a glass slip in a drop of some reagent and cover it with a cover-glass, and we carefully heat it so that the liquid between the slip and cover-glass may slowly boil. Another process consists in treating the sections for a quarter of an hour with a five to ten per cent. solution of potash, and then they are stained with ammoniacal Congo-red so that they may be studied in water. *When characters have been described from dried specimens we must always indicate the technical details that have been employed in their study.* For the study of the spores it is best to use a good objective with a homogeneous immersion. I use a LEITZ 1/16 immersion; but one can also use a 1/12. The spores may be measured either by a drawing with the camera lucida and a comparison with it of a micro-metric scale obtained under the same conditions with the same objective, or by means of a micrometrical scale placed in the eye-piece, the micrometrical value of which scale has been previously ascertained by a micrometer measure placed on the stage of the microscope, that is to say the number of divisions of the micrometer measure that correspond to the number of the divisions in the micrometrical scale of the eye-piece when used with the same objective. It is necessary to determine this yourself instead of adopting the figures given by the maker for the micrometrical values of their objectives, because they are very often wrong in this respect. Contrary to the opinion of some mycologists the spores can be measured very well in the sections of the gill. The section includes many

* Solution of cotton blue C 4 B and Soudan III. in lactic acid, to which is added a small quantity of an alcoholic solution of iodine.

** A mixture of glycerine, phenol and lactic acid.

ripe, detached spores which are motionless and in all possible positions in the preparation so that we can work with the microscope inclined. With a little practice we can very easily distinguish the ripe spores from the unripe. Further we can control it by an examination of the spores obtained from a deposit either on paper or glass. This control has always given me the same results that I have obtained by the other method. I will now detail the characters that we shall study in our preparations. We shall study in the section of a gill, the edge, the mediostratum, the subhymenium, the cystidia, the basidia and the spores. In the cuticle we shall study, the general structure, the viscidity, the cystidia and the differentiated hairs.

Edge of the gills. The edge may be *homomorphic* or *heteromorphic.* We call the edge homomorphic when the hymenium is continuous with the same structure on the lateral face of the gills; on the other hand we term heteromorphic, the edges where the structure is changed by the presence of hairs or other elements differing from the hymenial elements. Sometimes the edge, without possessing any special elements, is differentiated by a considerable predominance of cystidia, a normal hymenial element; in this case the edge may be designated *subheteromorphic.* In the Russulae the characters of the edge are of much less importance than in many other genera of Agaricaceae (such as *Lepiota*, *Inocybe*, *Mycena*, &c.), the edge generally being homomorphic. In *R. nigricans* Fr. however we find the edge distinctly heteromorphic and furnished with either fascicled, or cylindrical or moniliform hairs. In *R. adusta* Fr. the edge is equally heteromorphic but in a much less marked degree, the hairs are few in number and much resemble cystidia, and moreover the heteromorphic edge of this species may not be quite constant. On the other hand *R. densifolia* Gill., so near to *R. adusta* Fr., always has homomorphic edges. The edge is still more clearly heteromorphic in *R. punctata* Gill. and has numerous hairs swollen at their base, long and accuminate at the summit.* Sometimes we find similar hairs disseminated over the lateral faces of the gills, and we shall see on the other hand that the cuticle of the stem is covered with them. The hairs on the edge are sometimes coloured, and this is the case when the edge is purplish. These hairs, whether coloured or uncoloured, always make the edge a little floccose, as we pointed out a little higher up. Be that as it may, the very characteristic hairs of *R. punctata* Gill. (= *R. amoena* Quél.) enable us to recognize this species under all its numerous disguises. The edge is subheteromorphic in *R. pseudo-integra* Arn. & Goris, and the

* These hairs have already been seen and figured by PATOUILLARD. Cf. *Tabulae analyticae*, No. 621.

cystidia become extremely numerous and projecting, and so produce the floccose appearance that I have mentioned.

Mediostratum of the gill. The mediostratum is the trama of the gill, it is the tissue which forms the frame and which through the medium of a differentiated peripheral layer, the sub-hymenium, supports the hymenium. The mediostratum in the majority of the Russulae consists of sphaerocysts mixed with filaments in various proportions. When the filaments or hyphae are of little importance, in comparison with the sphaerocysts, we call the mediostratum vesicular, when the filaments predominate then we term it filamentous. There is every form of transition between these two types, hence the structure of the mediostratum is of no importance except in those species where it is decidedly characteristic. It is so in *R. chamaeleontina* Fr., and *R. melliolens* Quél., where the mediostratum is vesicular, although in *R. punctata* Gill., and *R. cyanoxantha* Fr. it is filamentous. These variations in the structure of the mediostratum are the cause of the fragility and elasticity of the gills. Species with vesicular mediostratum have the most fragile gills and this fragility is due to the inversion of the density of the tissue. The species on the other hand that have a filamentous mediostratum possess gills more or less elastic. The mediostratum in the majority of species does not have any lacticiferous vessels, hence it is useful to note those species in which it occurs. These species are especially very acrid Russulae such as *R. drimeia* Cke., *R. Queletii* Fr., *R. sanguinea* Fr., *R. maculata* Quél. and *R. emetica* Fr.

Sub-hymenium. The sub-hymenium is a layer that separates the mediostratum from the hymenium and directly bears the basidia. The subhymenium is generally formed of filamentous cells more or less entangled, which are more and more branched and shortened towards the hymenium under which they are sometimes almost isodiametrical. This structure amongst the majority of the Russulae presents only insignificant variations; the subhymenium is either a little more or a little less thick, and either a little more or a little less dense, but it always has the same appearance. We call this type along with FAYOD (1889) the *branched subhymenium.* This structure in some species is modified by its tendency to become vesicular; the sub-hymenium then becomes less distinct from the mediostratum and the fragility of the gill is considerably increased. This type corresponds to the *cellular subhymenium* of Fayod and is well represented in *R. chamaeleontina* Fr., *R. lutea* Fr. and some other neighbouring species and varieties. FAYOD (1889) distinguished at the base of the subhymenium a layer formed also of thinner entangled elements which he called the hymenopode.

In my opinion the hymenopode is too little differentiated and too variable in the Russulae to be of any taxonomic value.

Cystidia. The cystidia are present in all Russulae except perhaps according to MASSEE in *R. virginea* Cke. & Mass. They are of deep origin and arise from the subhymenium or even the mediostratum. *Sometimes* but *not always* they are connected with the lacticiferous vessels when they are present in the gills. Their general shape is pretty constant in the Russulae; they are more or less fusiform and either somewhat acute or obtuse at the apex. Their contents vary much with age, as DE SEYNES (1867) and TOPIN (1901) have shewn. At first hardly granular and uncoloured, the contents are obscured by little oil drops often yellowish in appearance, then towards the commencement of the formation of the spores we see the oleaginous drops absorbed and vanished. The cystidia have then ended their function as secretive cells and have become excretive, and their contents are often filled with crystals, and sometimes the external membrane is encrusted with them on the outside. In this last phase the cystidia are extremely turgescent and break up when placed in water. The cystidia in the Russulae have often a tendancy to bud at the apex, in a way that they often appear to have either a little globular or cylindrical or moniliform body at the top: we then call them *appendiculate cystidia.* This character is not very constant and we almost always find appendiculate cystidia with others that are not so in one and the same specimen; however it is well to note that in some species the appendiculate cystidia are very abundant (*R. melliolens* Quél., *R. cyanoxantha* Fr., *R. heterophylla* Fr., *R. Queletii* Fr., &c.) although in some others they are rare or absent (*R. chamaeleontina* Fr., *R. Turci* Bres., *R. aurata* Fr., &c.). The external incrustation of the cystidia is important because to our knowledge it is only met with in *R. pseudointegra* Arn. & Goris, where it was first drawn attention to by these authors. The incrusting substance forms a sheath to the cystidium up to a certain height leaving the apex free from it for a more or less considerable distance. This substance dissolves pretty quickly in water, but on the other hand it is insoluble in the sulphovanillic reagent. The length of the cystidia vary much more with the position they occupy on the gill than with the species; they are always shorter at the edge of the gill and longer towards its base. Their length is consequently not very precise and difficult to make use of unless we take into account various measurements at different levels. The width is more constant and sensibly varies from one species to another in some cases. Thus the cystidia of *R. nigricans* Fr. do not exceed 6μ in width, although those of *R. melliolens* Quél. and *R. decolorans* Fr. are hardly ever as low as 9μ and rise up to 12μ. The width is measured where the

cystidium is broadest. It is useful to note whether the cystidia project or not at maturity. This character is generally little noticeable and variable; however MASSEE (1893) drew attention to the fact that the cystidia of *R. cyanoxantha* Fr. generally project very much whereas they scarcely exceed the hymenium in *R. heterophylla* Fr. The Russulae of the *Compactae* section often have this last character, *R. nigricans* Fr., *R. adusta* Fr. and *R. delica* Fr.

Basidia. The basidia vary very little in the Russulae. They have four spores in all the species; and it is better to take no notice of anomalous forms with one to three spores. The shape of the basidia varies between two extreme types: the long basidium, narrowly clavate (*R. nigricans* Fr.) and the short, broad clavate basidium (*R. chamaeleontina* Fr.). The dimensions, although varying within somewhat extensive limits, ought to be noted, because certain Russulae have basidia of very large size, which are clearly distinct from those of medium and smaller sizes in other species. Such are the basidia of *R. melliolens* Quél., $45\text{-}55 \times 18\text{-}20\mu$, whilst those of *R. rosacea* Quél. are $30\text{-}35 \times 7\text{-}9\mu$, *R. chamaeleontina* Fr. $30\text{-}38 \times 10\text{-}11\mu$, and *R. nigricans* Fr. $50\text{-}60 \times 9\text{-}10\mu$.

Spores. The microscopical study of the spores furnishes, contrary to the opinion of the majority of the authors, many very valuable characters for their determination. It is then necessary to study the spore in its general shape, dimensions, colour, armature of the membrane and its contents. The shape varies within rather restricted limits: they are generally elliptical with an apiculus at the hilum and a little depressed on the interior side, the spores become shorter and subglobose in certain species (*R. melliolens* Quél., *R. pseudointegra* Arn. & Goris) and sometimes they are elongated (*R. xanthophaea* Boud.). Their dimensions usually vary very little. In the majority of species the length approximates to 9μ. Certain Russulae however have spores clearly much larger than the average; thus those of *R. melliolens* Quél. are generally $10\text{-}13 \times 8\text{-}11\mu$ and those of *R. decolorans* Fr. are $11\text{-}13 \times 8\text{-}9\mu$. Besides the species with large spores there are others where the spores are remarkably small, *R. heterophylla* Fr. (spores $5{\cdot}5\text{-}7{\cdot}5 \times 5\text{-}6\mu$), and *R. virginea* Cke. & Massee (spores having a diameter of 4μ according to MASSEE). Often very nearly related species are easily distinguished by the size of their spores: thus *R. obscura* Romell. so near to *R. decolorans* Fr. has spores $9\text{-}11 \times 7{\cdot}5\text{-}8\mu$. These differences of size are habitually very constant. There are many important points that we should not forget when we measure the spores. First we should indicate in the measurement of the length of the spore whether it includes the apiculus

or not, as this has a length that is far from being of no importance ($\cdot 5$-1μ in *R. heterophylla* Fr., 1-1·5 and also 2μ in *R. decolorans* Fr., &c.). I do not include the apiculus in the measurements given in this paper and probably MASSEE does not include it in the measurement quoted above, but he makes no statement as to this. Secondly, if the measurements are obtained by a micrometrical scale in the eye piece, it is best, in order to have sufficient preciseness, to use a high power objective and preferably the homogeneous immersion the 1/16. Lastly, the measurements should be confined to ripe normal spores and should indicate the maximum and minimum dimensions of these, neglecting those abnormally small or unusually large and only mentioning these separately if we desire to do so. The colour of the spore as seen through the microscope should be noted, but we must not attribute the same importance to it that we do to the colour of the spores deposited in mass; first because it is extremely difficult to observe when they are very pale, and secondly because, without taking into consideration the use of artificial light, it changes greatly with the colour of the sky. *The determination of the colour of the spores, as seen through the microscope, cannot in any case, replace that of the colour of the spores as seen when deposited in mass.* The spores are hyaline under the microscope in those species that have white or cream-white spores; they appear slightly yellowish in those with ochre-cream spores and distinctly yellow in the species with yellow-ochre spores. The colour of the spore, is not always due to its contents, as FAYOD has observed, but it often, also, arises from the tint of the membrane. The armature of the membrane of the spore is an important character, which has almost been completely neglected, hitherto, by the majority of mycologists. Few of them have noticed the almost smooth spores of certain *Russulae*, *R. nigricans* Fr., and *R. virginea* Cke. & Massee. In 1908 BATAILLE still says "Their surface . . . . is generally either echinulate or aculeate, sometimes simply granular or warted, very rarely nearly smooth." The little importance attached by the authorities to the armature of the spore is due to the fact that they have always worked with too low a power objective or with one insufficient in definition. In certain cases this armature can be observed with a good dry objective, but it is more often better defined by an immersion objective.* To obtain the best figures as clear as possible it is

* These objectives are so much improved now and their price is so low that all mycologists having a microscope can use them with an *Abbé* condenser in the substage. The management of immersion objectives is not much more difficult than that of the ordinary dry objectives, and we can use them for the examination of specimens in water and not mounted, provided that we do not leave too thick a layer of cedar oil which we employ with the immersion.

best to use artificial light, either an AUER'S gas burner, or a NERUST'S lamp or an EDISON'S incandescent light with roughened glass; if these be unobtainable, then either a petroleum or alcohol incandescent or acetylene lamp should be used. Day-light is too inconstant and often too weak, especially in winter, to produce from the objectives their maximum of efficiency. The spores of the Russulae, when studied under these conditions, furnish differences in their armature which enable us to distinguish three distinct types; the echinulate, the cristate and the somewhat smooth. In the echinulate type, the spore is covered with long spines more or less pointed; in the cristate type, the spines are elongated in more or less anastomosing crests, so that they sometimes appear somewhat reticulate, and lastly, in the somewhat smooth type, the spore has sometimes either low warts very distant and scarcely visible, or some simple wrinkles which are irregular and little apparent. There are clearly numerous transitions between these three types: the most frequent is the warted spore with very distinct and pretty high warts which are more or less rounded. We can quote as examples of the type with echinulate spores: *Russula chamaeleontina* Fr. and *R. alutacea* Fr. The cristate type is very well represented by the spores of *R. Turci* Bres., *R. Romellii* Maire and *R. aurata* Pers.; and the somewhat smooth type by *R. nigricans* Fr., *adusta* Fr, and *melliolens* Quél. The contents of the spore are very constant in the Russulae; they consist of a parietal protoplasmic layer, containing two nuclei which are only visible after fixing and staining with an appropriate reagent, and of a central nearly spherical, large oil drop. Occasionally we find a supplementary little drop or two drops of medium size in place of the large drop. The contents of the spore, in the present state of our knowledge, are of no importance to the systematist. In concluding these remarks upon the spores we cite as an example of the utility of its careful study the case of *R. melliolens* Quél. This species is badly known by the majority of mycologists, is extremely polymorphic, and is very difficult to recognise with the naked eye, when it is young, and we have failed to determine it in the field although we have studied hundreds of specimens. But this species, so disconcerting to the naked eye, is easily recognised when we study its large, subglobose, somewhat smooth and hyaline spores. We cite again *R. cutifracta* Cke., which is distinguished from *R. grisea* Bres. by its cristate spores.

Cuticle of the pileus. The structure of the cuticle of the pileus often furnishes very important systematic characters in the Russulae, and as FAYOD has well remarked it is because FRIES based his descriptions on these macroscopic characters that his sections are so very natural. The most frequent type

of the cuticle of the pileus consists of an external layer (the *epicutis* of Fayod) formed of more or less upright and pigmented hyphae, with a slimy membrane, intermixed with cystidia, and an internal layer (the *hypoderme* of Fayod) with more or less procumbent hyphae, which are not slimy but deeply coloured and densely entangled. The internal layer passes either more or less abruptly or on the other hand gradually into the flesh of the pileus. *Russula fragilis* Fr. may be taken as an example of this type of cuticle. The slime of the external layer in this species very readily swells up, hence the viscidity of the cuticle: and we find very numerous uncoloured cystidia. The hyphae of the external and internal layers contain a red pigment dissolved in the cell sap which makes the vacuoles conspicuous. Numerous lacticiferous vessels are found in the internal layer and in the flesh of the pileus which generally have no connection with the cystidia belonging to the external layer. This type of cuticle varies in different ways: by the absence either of lacticiferous vessels (*R. decolorans* Fr.), or of cystidia (*R. carnicolor* Bres., *R. melliolens* Quél. and *R. lutea* Fr.), by the solubility of the great part of the slime, leaving the superficial hyphae relatively free in times of drought (*R. alutacea* Fr.), by the absence of swollen up or soluble slime (*R. lepida* Fr., *virescens* Fr. and *punctata* Gill.), by the transformation of the hyphae in the external layer into a pseudoparenchyma, and the external cells alone are elongated into short hairs (*R. virescens* Fr.), by the replacement of the cystidia by hairs clearly differentiated amongst the ordinary hyphae of the external layer (*R. caerulea* Cke., *R. Turci* Bres., *R. rosea* Quél. and *R. pseudo-integra* Arn. & Goris), by the juxtaposition of these hairs with cystidia (*R. ochroleuca* Fr., and *sororia* Gill.) and by the diminution of the distinct separation between the external and internal layers (*R. nigricans* Fr., *R. delica* Fr. and *R. adusta* Fr.) The differentiated hairs of the pileus are often warted (*R. ochroleuca* Fr.) or incrusted (*R. Turci* Bres. and *R. caerulea* Cke. These hairs are homologous to the cystidia but they are not generally secretive; in *R. ochroleuca* Fr. we can clearly perceive the passage from hairs into cystidia. The cystidia of the pileus are generally of a similar shape to those of the gills, but they are more irregular and rounded at the apex. They are also sometimes furnished with appendages; their length and breadth are very variable. They are developed frequently by the ramification of the pigmented hyphae of the external layer but at other times they proceed from the internal layer. The pigmentation of the cuticle varies much. In *R. fragilis* Fr. we have seen that the colour of the cuticle is due to a red pigment dissolved in the vacuoles. In *R. atropurpurea* Krombh. the pigment of the cuticle of the pileus is made up of purple globules which are

developed in the vacuoles filled with an uncoloured cell sap. In *R. cyanoxantha* Fr., *R. grisea* Bres. and *R. Romellii* Maire we find a violet or purplish pigment in the vacuoles, and a greenish-black pigment disseminated in crystalline granules in the vacuoles. The tint varies from violet to olive according to the more or less large proportion of one or the other of these pigments. We are able to distinguish three types of pigmentation that can exist together in the same specimen, dissolved pigments, globular pigments and crystalline pigments. I cite, as an example of the utility of the study of the structure of the cuticle of the pileus in determinations, the cases of *R. chamaeleontina* Fr. and *R. lutea* Fr. These two species much resemble one another and decoloured forms of the latter are easily mistaken for the former. But the cuticle of the pileus in *R. chamaeleontina* Fr. always has cystidia which are absent in *R. lutea* Fr.

Cuticle of the stem. The cuticle of the stem is not very thick and is often lax, so it is consequently never separable. It generally consists of very thin layers of uncoloured decumbent hyphae, on which the hair-shaped, uncoloured hyphae and cystidia are placed, and these give the young stem its pulverulent appearance. Very often the cuticle of the stem is too thin and does not sufficiently conceal the projection of the strings of sphaerocysts beneath it and this explains the wrinkled-striate look of the stem. In this case the cuticle soon ceases to grow and disappears almost entirely except at the base of these wrinkles. This is the reason why the stem which is more or less mealy pulverulent when young becomes at maturity glabrous except at a few points. This structure varies in certain species, by increase in the thickness the growth of the cuticle is maintained for a longer period with the result that the stem at maturity is smooth and pruinose (*R. drimeia* Cke., *R. Queletii* Fr. and *R. lepida* Fr.); by pigmentation of the hyphae (*R. drimeia* Cke., &c.); by the absence of cystidia (*R. virescens* Fr., *R. alutacea* Fr. and *R. rosea* Quél.); by the conjunction of differentiated hairs and cystidia (*R. ochroleuca* Fr.); by the substitution of these hairs for cystidia (*R. caerulea* Cke. and *R. Turci* Bres.), and by the transformation of hyphae into a cellular tissue, the most external cells of which elongate into long and acuminate hairs (*R. punctata* Gill.). The cystidia of the stem, both in shape and length, are perhaps still more variable than those of the pileus, sometimes also they have appendages, they are often connected with the lacticiferous vessels which circulate in numerous species in the deeper parts of the cuticle of the stem and in the filamentous tissue, which separates the strings of sphaerocysts. The cuticle of the stem although generally more uniform than that of the pileus, can in many cases furnish very valuable characters for the systematist.

C. THE USE OF MACRO- AND MICRO-CHEMICAL REACTIONS.

Chemical characters are pretty frequently used in the descriptions of fungi, but only in their most rudimentary form, the indication of the smell and taste, organoleptic properties directly due to their chemical constituents. The coloured reactions usually employed by lichenologists have not as yet their counterpart in mycology. However the use of reagents capable of giving colour reactions has been applied in certain branches of mycology, and more especially in the Russulae and Lactarii. The chief reagents used up to the present in the study of the Russulae are, first, the alcoholic solution of guiacum, and secondly the sulphovanillic and sulphoformolic reagents,

The alcoholic solution of guiacum. SCHONBEIN (1856) showed that many fungi turned the alcoholic solution of guiacum blue because of the presence in their tissues of oxydizing enzymes or oxydases which act in the presence of atmospherical oxygen on the guiaconic acid contained in the resin of guiacum. To demonstrate this reaction it is sufficient to put some drops of the alcoholic solution of guiacum upon a radial section of the fungus, when it more or less quickly turns blue and generally within one or two minutes. When the change to blue occurs after the lapse of half an hour or an hour, it is not attributable to the oxydases, but to the direct action of oxygen or perhaps atmospheric ozone. All the Russulae contain oxydases which turn the tincture of guiacum more or less rapidly blue to a greater or less extent. Generally the change to blue is produced in all parts of the Russula, although often also with greater intensity in certain parts, as for example in the cuticle of the stem. Some species however possess constant peculiarities in this respect which enable us to distinguish them from the others. Thus *R. rosea* Quél. and *R. pseudo-integra* Arn. & Goris turn the alcoholic solution of guiacum blue in the gills, but only slowly and feebly elsewhere. *R. subfoetens* Sm. does not turn the solution of guiacum blue except in the cuticle of the pileus in young specimens.

Sulphovanillic and sulphoformolic reagents. These liquids are used as reagents of phenols, and render great assistance to the study of the Russulae. The sulphovanillic reagent was introduced into mycological studies by ARNOULD et GORIS (1907); it was first used in the micro-chemical research for phloroglucin by LINDT (1885), then by REICHL et MIKOSCH (1890) for the microchemical characters of the proteids, and lastly by RONCERAY (1904) for the investigation of orcin in the orchill-lichens. The formulae given by these authors differs in some details, and I have followed the one indicated by ARNOULD et GORIS after RONCERAY.

Distilled water	-	2 cc.
Pure sulphuric acid	-	2 cc.
Vanillin	-	0 gr., 25.

It is necessary to use a very pure vanillin, such as *Merck's* for example, because some of the commercial vanillins give an abundant deep blue precipitate when they are mixed with water and sulphuric acid, and are useless. This reagent will keep for a very long time in a yellow glass bottle, but in consequence of the great percentage of sulphuric acid that it contains there is always a tendency to hydrate itself, which causes a precipitation of the vanillin. It is therefore necessary from time to time to add some drops of sulphuric acid and to renew the reagent when it has become too attenuated. The sulphoformolic reagent was suggested to me by ARNOULD, and I have much pleasure in thanking him specially here for his kind assistance in my work with the Russulae. We employed according to his indications the following formula:—

Distilled water	-	xxv. drops.
Pure sulphuric acid	-	1 cc.
Formol (40% solution)	-	lxxv. drops.

This reagent keeps still better than the sulphovanillic reagent but it naturally has the same tendency to hydrate itself. The two above reagents give absolutely parallel reactions and may be employed indifferently the one in the place of the other, but it is better to use the two, because this gives us the advantage of a permanent control of the reactions. We can use them either for direct application on the fungus with the naked eye or for the microscopical study of sections. The second method of employment is the most useful in the majority of cases. We have indicated before how one prepares these sections destined to be studied by means of these reagents and how they are subsequently mounted. We find by microscopical examination that the tissues remain uncoloured under the action of the sulphoformolic reagent, although the cystidia and the lacticiferous vessels take in the majority of species a tint more or less deep of mahogany-brown, due to the colour of the oil drops in a more or less state of emulsion in their contents. Young cystidia give the most intense reaction; when old they give little or none, because their contents have become rarified. We find moreover that the acridity of the fungus corresponds with the intensity of the reaction and the abundance of the organs reacting. Young specimens of the most acrid species, such as *R. drimeia* Cke. and *R. sardonia* Bres. become almost quite brown because of the great abundance of the cystidia and of the lacticiferous vessels and the intensity of their reaction, in the gills, the peripheral portions of the stem and in the cuticle of the pileus.

Absolutely mild species on the other hand do not possess lacticiferous vessels, and very few cystidia give any reaction. We know, on the other hand, that the acridity disappears in dried specimens: and it is the same for reactions in the case of the cystidia and lacticiferous vessels in dried specimens, so that their study is of no use. These considerations lead us to suppose that the acridity of the Russulae is due either to phenols or to a body having a phenol molecule. Be that as it may the diverse degrees of this reaction, as especially its absence, enables us to characterize certain species. Thus in *R. maculata* Quél. the cystidia of the stem and gills are coloured, but not those of the pileus; on the other hand they are distinctly characterized by the absence of any reaction in *R. pseudo-integra* Arn. & Goris, *R. punctata* Gill. and *R. lepida* Fr. *R. rosea* Quél. possesses a reaction absolutely unique, in my opinion, and enables us to recognise it in all its forms. No part of it becomes brown under the action of the sulphoformolic reagent (except a few cystidia which sometimes react very feebly) but *the flesh in all parts of the carpophore becomes light blue after the expiration of a few minutes.* The case of *R. rosea* Quél. is the first record of the macroscopic employment of this reagent. The change to blue is easily affected if we let a drop of the sulphoformolic reagent fall upon any part of the fungus (with the exception of the cuticle of the pileus where the pigment obscures this observation). If we use the sulphovanillic reagent the reactions are different but parallel. Whenever the tissue remains uncoloured by the sulphoformolic reagent then the sulphovanillic reagent colours it more or less red; wherever the former stains mahogany-brown there we notice a more or less blue tint. The intensity of the blue colour and the abundance of the cystidia and lacticiferous vessels which they represent corresponds here also with the acridity of the species. The species that do not give a blue reaction to the sulphoformolic reagent, give a red reaction as in all other fungi. This red colour is due to the protoplasm being coloured by the reagent; it is very feeble in the ordinary tissues and the spores, on the other hand it is much more intense in the hymenium where the protoplasm is very dense. In the protoplasm of the cystidia this red reaction is often seen by the side of the blue reaction caused by the secreted matter. Macroscopically there is no red tint or only a very faint one, with the exception of that on the hymenium. This red reaction is of no importance to the systematist; it is very general and has caused the use of vanillin as the reagent of protoplasm. The blue reaction, on the contrary, has the same value as the mahogany-brown reaction of the sulphoformolic reagent. *R. rosea* Quél., which gives such remarkable peculiarities with the sulphoformolic reagent behaves also in a very peculiar fashion

with the sulphovanillic reagent. It does not give the blue reaction, but on the other hand it produces instantaneously an *intense carmine-red reaction in all its tissues.* This reaction is easily observed macroscopically: every spot touched with a drop of the sulphovanillic reagent immediately becomes deep carmine-red; it acts therefore as a useful control to the reaction produced more slowly and with less intensity by the sulphoformolic reagent. The carmine-red reaction of *R. rosea* Quél. is quite different from the usual red reaction. This is much less intense, the red is more violaceous and is produced in the protoplasm: consequently it is little noticeable in the flesh, which is richer in cell sap than protoplasm. The former, on the contrary, proceeds from the cell sap, which it colours very strongly, and we can often see little purple crystals precipitated; it is then often very intense in the flesh. There are certainly other chemical reagents that mây be of use to the systematist. Thus many of the aldehydes considered as reagents of the phenols have been used by LINDT concurrently with vanillin as reagents of the albumenoids, and may be employed in the study of the Russulae. Such are the following aldehydes, benzoic, salicylic, cinnamic, &c. M. ARNOULD has very kindly made some experiments with these different reagents, which were crowned with success. With the benzoic aldehyde, for example, he obtained a black coloration parallel to the blue one obtained by vanellin. But these reagents are much more difficult to use than the sulphoformolic and sulphovanillic reagents, so it is consequently best to employ these last. The same chemist has further found that the bodies which contain formol (urotropine, trioxymethylene, &c.) react in the same way, this may be of use to those people who are troubled by the irritating vapours given off by the sulphoformolic reagent. The membrane of the spores of the Russulae often turns blue either directly with iodine or with iodine and sulphuric acid; it would be useful to find out if we could systematically apply these reactions. Potash, which generally discolours the cuticle of the pileus, after changing to yellow, sometimes very pronounced, turns that of *R. fellea* Fr. into a greyish violet. Let me remind you that in the neighbouring genus the cuticle of *Lactarius turpis* Fr. is changed into violet.

III. Summary of the Method for the Description of the Russulae.

I think it is useful to sum up in the following table the characters studied above, trusting that it may be of use to mycologists desirous of either studying or describing a Russula so that they may not omit any important character.

A. Macroscopical characters.

1. General characters.

Size—Taste—General colour of the flesh and its alterations—Firmness—Smell—Colour of spores in the mass.

2. Characters of the stem.

Shape—Appearance and colour of the surface—Dimensions—Interior structure.

3. Characters of the pileus.

General shape—Dimensions—Margin.
Cuticle: colour, viscidity, adnation, aspect of the surface, colour of the flesh under it.

4. Characters of the gills.

Colour—General shape—Width—Thickness—Edge—Insertion on the stem—Spacing—Intervenation.

B. Microscopical characters.

1. Characters of the gills.

Edge—Mediostratum—Subhymenium—Cystidia—Basidia.
Spores: colour, shape, size, armature of the membrane, contents.

2. Characters of the cuticle.

Cuticle of the pileus: general structure, cystidia, hairs.
Cuticle of the stem: cystidia, hairs.

C. Chemical characters.

Action on the alcoholic solution of guiacum.
Action of sulphoformolic and sulphovanillic reagents.
Action of potash.

NEW OR RARE MICROFUNGI.

By A. Lorrain Smith, F.L.S.

DISCOMYCETES.

MICROGLOSSUM Gillet. Disc. Fr., p. 28 (1879), emend. Rehm in Rabenhorst's Krypt-Flora 1, 3, p. 1151.

Ascophore upright, more or less clavate, the apical thickened portion more or less distinct from the stem and covered with the hymenium, dark-coloured, fleshy or mucilaginous; Asci clavate, 8-spored; spores fusiform or elliptical, straight or slightly bent, continuous or finally 2- or more-septate, and bi-seriate; paraphyses filiform, slightly larger upwards.

Differs from *Mitrula* in the stouter, dark-coloured ascophores, and from *Geoglossum* in the colourless spores. Two other species of the genus *M. viride* Gill. and *M. olivaceum* have been included by various authors in *Mitrula* (c.f. Massee's Fungus Flora IV., pp. 482-3.

Microglossum atropurpureum Karst. Rev. Monogr. Asc. in Act. Soc. Fauna and Fl. Fenn. II. 6, p. 110 (1885).

Ascophore fasciculate, upright, 4-8 cm. high, the fertile head 1-2 cm. high, from ·5-1 cm. thick, ovate or often compressed and tongue-like, dark-brown, reddish or purplish; stem cylindrical, minutely and slightly squamulose; asci clavate, rounded above, 70-90μ long $\times$ 8-10μ thick; spores fusiform, somewhat bent, colourless, 22-33$\mu \times$ 4-6μ, irregularly bi-seriate; paraphyses filiform, 2μ thick, slightly thicker above and brown at the tips, forming an epithecium.

Among grass, Corrie, I. of Arran. Collected by Miss Bertha Reid, Oct., 1909.

The spores are multiguttulate, but none of them show any trace of septation. Rehm notes that English examples received from Phillips as *Geoglossum glabrum* (non Phillips Elvell, Brit. n. 55) become at last 4-septate. The asci in the Arran specimen measure up to 100μ in length.

PYRENOMYCETES.

Melanospora leucotricha Corda. Icones I., p. 25, t. vii., f. 297.

Perithecia gregarious, globose, whitish-yellow, soft, surrounded by and seated on a colourless felted mycelium, up to 300μ in

diameter, with a cylindrical slightly tapering beak and with lc. whitish hairs at the apex; asci oblong, stalked, 4-8-spored, 38-50μ long, 17-23μ wide; spores irregularly massed, broadly elliptical, brown, with a hyaline point at each end, 19-21μ × 13-15μ.

On decaying leaves, stalks, branches &c., sometimes spreading to stones. Found by Dr. G. Pethybridge on decaying Cherry Laurel leaves, Monaghan, June, 1909.

GIBSONIA Mass. in Ann. Bot. XXIII., p. 336 (1909).

Perithecia subglobose, superficial, membranaceous, olivaceous with a long cylindrical ostiole, fimbriate at apex; asci disappearing, 8-spored; spores simple, brown, ellipsoid, ejected in a mucilaginous mass.

G. phaeospora Mass. l.c. 3 figs. in text.

Perithecia scattered, about 1 mm. high, sub-globose, olivaceous, with a parenchymatous tissue composed of polygonal cells, smooth with creeping hyphae at the base, passing abruptly into the long ostiole; asci cylindrical; spores monostichous, ellipsoid, brown, simple, 14-15μ × 7-8μ.

Found sparingly by Prof. Harvey Gibson on a decomposing mass of *Saprolegniae* in N. Lancashire.

Gnomonia herbicola A. L. Sm. sp. nov.

Perithecia immersed, membranaceous, black, depressed-globose, the cells of the perithecial wall polygonal, rather stout-walled, dark-brown, 200-250μ high, 60-70μ thick, ostiole projecting, black; paraphyses none; asci abundant, clavate, fusiform, with a short thick stalk 25-40μ long, 5-7μ thick; spores 8 in the ascus, colourless, ellipsoid-fusiform, continuous or faintly 1-septate (3-4 guttulate), 8-12μ × 2-2·5μ.

Gregarious at the base of living stems of *Epilobium hirsutum* near Melbourne and Wirksworth, Derbyshire. Collected by Mr. T. Gibbs, junr., July 1908 and 1909.

Characterized by the small spores. In water the spores seem to be continuous but after treatment with lactic acid a septum is visible in them all below the middle of the spore.

SPHAEROPSIDEAE.

Phoma muscicola A. L. Sm. sp. nov.

Perithecia minute, from 120μ to 150μ in diameter, opening by a small pore; spores oblong-elliptical, minute, colourless, about 5μ × 2μ.

On moss capsules (*Bryum* sp.). Found by J. A. Wheldon

ear Freshfield, Lancashire, on sand dunes, with a rich flora of mosses, especially species of *Bryum*, no fewer than 13 species and varieties growing in the immediate neighbourhood.

Septoria Antirrhini Desm. Sacc. Syll. III., p. 535 (1884).

Spots yellowish. Pycnidia on both sides of the leaf, very small, 50μ to 70μ in diameter, rather prominent, numerous, crowded or scattered, with an opening at the apex; spores cylindrical, obtuse, bent or curved, 4-7-guttate, one-celled, 15-20μ × 2-2·5μ.

On leaves and stems of *Antirrhinum majus*, Devonshire. F. J. Chittenden, F.L.S., in Journ. Roy. Hort. Soc. XXXV., p. 216, fig. 82 (1909).

Septoria Petroselini Desm. var. *Apii* Br. & Cav.

The perithecia occur scattered over the whole leaf surface and not upon distinctly coloured spots as in the type on Parsley. It occurs frequently in Britain on leaves of Celery which are killed by the attack.

Surrey, etc., October, 1909. Comm, by F. J. Chittenden.

Cytospora Sambuci A. L. Sm. sp. nov.

Stromata small, immersed, flat at the base, converging upwards to a single conical ostiole, one or more-chambered, the walls of the chambers thickly beset with simple slender sporophores, about 25μ long; conidia abundant, minute, colourless, simple, cylindrical, 5μ × 1μ.

On the bark of twigs of *Sambucus* causing small round dark swellings. Collected by T. Gibbs, jun., at Wirksworth, Derbyshire, Oct., 1909.

Coniothyrium Fuckelii Sacc. in Nuovo Giorn. Bot. Ital. VII., p. 318 (1878).

Already recorded by Mr. H. T. Güssow (Journ. R.H.S., vol. xxxiv., pt. 2) from Antrim. On rose stem, causing canker, Buckinghamshire, Thetford, Norfolk, etc., 1909. (Comm, by F. J. Chittenden.)

PHLYCTAENA Mont. et Desm. in Ann. Sci. Nat., 1847, p. 16.

Perithecia developed under the bark, erumpent, globose-elongate, opening somewhat elongate; spores elongate-fusiform or threadlike, simple, colourless.

Phlyctaena Pseudophoma Sacc. Syll. III., p. 595 (1884).

Perithecia congregate covered by the epidermis, then emergent, elongate-elliptical in form, somwhat depressed; spores thread-like, bent at the end, one-celled, colourless, 24-28μ × 1-1·5μ thick.

On Poplar branches, &c., Baslow, Derbyshire, Sept., 1909.

The specimen collected at Baslow agrees in most of the characters with those given above, the spores escape in thread-like faintly yellowish masses. They have the "walking-stick" form and are colourless when moist.

HYPHOMYCETES.

Cylindrium griseum Bon. Abh., p. 88 (1864).

Tufts flat, spreading, grey, somewhat granular. Conidial chains sometimes branched; conidia cylindrical, blunt and rounded at the ends, colourless, 15-18μ long $\times$ 2μ thick.

On decaying leaves of deciduous trees, chiefly Oak and Hazel.

On the under surface of Walnut leaves, Baslow, Derbyshire, Sept., 1909.

The flat tufts of the fungus spread over the whole leaf. It is not new to Britain but has not been clearly distinguished from other species.

Sporotrichum lanatum Wallr. Fl. Crypt. Germ. ii., p. 276 (1833).

Tufts cushion-shaped, soft, elastic, of loosely interwoven branched hyphae; conidia numerous, globose, small, whitish at length falling off.

No measurements are given in any description of the species, but in the specimen from Yorkshire the woolly look is very characteristic, the spores are very abundant and are borne on short sterigmata, often in groups, near the tips of the branches. They measure up to 5μ in diameter.

On sill of settling tank of dye-works. Collected by Mr. J. W. H. Johnson, at Greetland, near Halifax, Yorks. The original substratum was decaying goose-feathers in Germany; it has also been found on paper in Holland.

Verticillium albo-atrum Reinke & Berth. Zersetz. Kartoff, p. 75, t. 8 and 9, figs. 1-11.

Mycelium developed within the substratum, spreading, brownish. Conidiophores upright, simple, dark coloured, lighter coloured at the apex with 3 to 5 verticels of up to 8 branches, the branches either simple or with verticellate branchlets, the final branches rather thicker at the base, tapering towards the apex; conidia elongate-ovate, colourless then brownish, 5-12μ $\times$ 3μ.

Parasitic on Potatoes. Found in Dublin by Dr. G. Pethybridge, in the Summer (1909), and reported by him.

The species has been placed by the authors, as also by Saccardo and Lindau, in the genus *Verticillium*, but the brown

colour of the mycelium and Conidiophores indicate its position among the *Dematieae* as *Verticicladium albo-atrum*.

Botrytis griseola Sacc. in Nuov. Giorn. Bot. Ital. VIII., p. 195 (1876).

Tufts somewhat woolly, grey, then darker. Conidiophores upright, stiff, sparsely septate, irregularly branched, the upper branches subverticillate, often pointed and naked at the apex, lighter coloured than at the base; conidia in small groups of 2-4, at the tips of the branches, smooth, colourless or greyish, globose, 5-6μ in diameter.

The specimen recorded differed in being of a somewhat more compact growth, the conidiophores springing in tufts from a common base; they were brown at the base and colourless upwards. Collected by Lady Muriel Percy on logs of wood at Syon, Kew.

PACHYBASIUM Sacc. in Rev. Mycol. VII., p. 160 (1885).

Hyphae felted, creeping, septate, branched. Conidiophores upright, branched, the main stem ending in a long sterile thinner pointed hypha; secondary branches alternate or verticillate, the ultimate verticils flask-shaped with a conidium at the tip; Conidia globose or elongate, colourless or brightly coloured.

Pachybasium Tilletii Oudem in Neder. Kruidk. Arch. ser. 2, IV., p. 536 (1886). Botrytis Tilletii in Ann. Sci. Nat., ser. 2, X., p. 308 (1858); Massee Fung. Fl. III., p. 316 (1893).

Recently found on dead bark at Alnwick, Northumberland, by Lady Muriel Percy.

Puccinia coronifera Kleb. in Zeitschr. Pfl.-Kr. IV., p. 133 (1894).

Separated by Klebahn from *P. coronata* Corda which has its aecidiospores on *Rhamnus Frangula*. The aecidia of this species differ somewhat from those of *P. coronata* and occur on somewhat thickened spots on the leaves, conspicuous by their bright yellow colour. Klebahn distinguishes six forms the teleutospores of which occur on *Avena sativa*, *Lolium perenne*, *Festuca elatior*, *Holcus*, *Alopecurus* and *Glyceria* respectively.

Aecidiospores on leaves of *Rhamnus catharticus*. Newlands Corner, Clandon, Surrey, June, 1909. (Comm. by F. J. Chittenden.)

Puccinia asteris Duby. var B. *Chrysanthemi Leucanthemi* C. Mass. in Nov. micol. Ver., p. 258 (Bull. Soc. bot. it. 1900).

Teleutosori forming roundish spots, congested; teleutospores clavate, 35-60 x 16-22μ, smooth, pale chestnut, more or

less constricted at the septum, cells unequal, upper much thickened at the apex, lower narrower, longer and elongated into the hyaline pedicel.

On leaves of *Chrysanthemum Leucanthemum.* Lamorna Cove, W. Cornwall, Sept., 1906.

[Previously recorded from Italy]. (Comm. by F. J. Chittenden).

SCHIZOMYCETES.

Hillhousia mirabilis G. S. West. & Griff. in Proc. Roy. Soc. LXXXI., pp. 398-405, 1 pl. (1909).

A sulphur bacterium of giant proportions: much the largest solitary bacterium which has so far been discovered. Its average length is about 60μ and breadth about 26μ.

Among decaying organic matter in the mud of shallow fresh-water pools. Found in various districts in Ireland and later in a pool at Stanklyn in Worcestershire.

NEW AND RARE BRITISH FUNGI.

By Carleton Rea, B.C.L., M.A., &c.

WITH PLATES XII. AND XIII.

Nolanea versatilis Fr. Mon. II. 297; Ic. t. 98, f. 5, Hym. Eur. 206, Quél. Fl. Myc. 167, and see pl. 12.

Pileus 2·5-5 cm. wide, submembranaceous, convex then expanded, obtuse or obsoletely umbonate, smooth, *glabrous*, *shining*, livid aeruginous, fuscous when dry. Stem 3-5 cm. long, 2-4 mm. thick, fistulose, rigid, smooth, greyish white *with a silvery sheen when dry*. Gills 3-4 mm. wide, adnate, ventricose, widest in front, distant, grey then sprinkled with the rosy spores. Spores pink, polygonal 9-10 × 7μ.

On bare ground amongst short grass, The Old Oak Park, Chatsworth, 30th September, 1909, and Chatsworth Gardens, 1st of October, 1909. C.R.

Nolanea araneosa Quél. Soc. Bot. XXIII., 327, t. 2, f. 3. Fl. Myc. 168 and see pl. 12.

Pileus 1-2 cm. wide, membranaceous, campanulate, dark grey, *fibrillosely silky*. Stem 3·5-4 cm. long, 2 mm. thick, fistulose, thin, fragile, fibrillose, grey, *with a greyish fugacious cortina*. Gills 2-3 mm. wide, adnate, greyish bistre then dusted with the rosy spores. Spores pink, oblong, pentagonal, 13-16 × 8-9μ.

On bare soil under Conifers, Chatsworth Gardens, 1st of October, 1909, Miss J. Eyre.

Nolanea exilis Fr. Syst. Myc. I. 206 and see pl. 12.

Pileus 1-1·5 cm. wide, membranaceous, conical then expanded, striate, glabrous, *livid bluish grey*, *apex darker and papillate*. Stem 5-6 cm. long, 2 mm. thick, fistulose, *filiform*, sticky, glabrous, *bluish green*, naked at the apex. Gills 2-3 mm. wide, adnexed, somewhat crowded, whitish then flesh colour. Spores pink, angular, 8-10 × 6-7μ.

Amongst short grass, pasture above Sheffield Wood, 28th of September, 1909.

Hebeloma sacchariolens Quél. Soc. sc. n. de Rouen, 1879, t. 1, f. 2. Caradoc and Severn Valley Field Club, Record of Bare Facts, 1908, p. 14.

Pileus 3-6 cm. wide, campanulate then convex, thin, glabrous, viscid, whitish with the disc buff coloured but the whole surface deepens in colour with age. Stem 4-5 cm. long, 1 cm. thick, thin, attenuated above and at the base, subfistulose, *striate*, *silky*, pruinose at the apex, white, *streaked with fawn fibrils below*. Gills 6-10 mm. broad, sinuato-adnate, crenate, whitish then buff colour and finally ferruginous with the spores, edge whitish. Spores deep ferruginous, almond shape, $10\text{-}11 \times 7\text{-}8\mu$, with a hyaline apical germ pore. *Smell very peculiar and strong;* according to Quélet like the odour of burnt sugar or of orange flowers, and in these British examples exactly recalling that of *Entoloma ameides* B. & Br.

On the ground, Broad Meadows, Benthall, Salop, Mr. W. B. Allen, 19th Oct., 1908.

Naucoria camerina Fr. Epic. 196. Ic. t. 124, f. 2. Hym. Eur. 259.

Pileus 1-2 cm. wide, somewhat fleshy, campanulato-convex, obtusely umbonate, glabrous, moist, *striate at the margin*, ochraceous tan, paler when dry, disc darker Flesh whitish. Stem 3-4 cm. long, 1-2 mm. thick, fistulose, wavy, *adpressedly fibrilose*, equal, *umber*, paler only at the apex. Gills 2-3 mm. wide, adnate, crowded, denticulate, *pale yellow* then cinnamon. Spores tawny, pruniform, $15 \times 7\text{-}8\mu$.

On an old Pine stump, Bolehill Wood, 28th of September, 1909, Docteur René Maire.

Galera Sahleri Quél. Jur. et Vosg. I. 235, t. 23, f. 4, Fl. Myc. 79, Fr. Hym. Eur. 272 and see pl. 13.

Pileus 4-8 mm. wide, membranaceous, campanulate, *often acutely conical*, glabrous, hygrophanous, striate, tawny chestnut when moist then honey colour when dry with the *disc brighter coloured;* margin at first covered with silky fugacious fibrils. Stem 1-3 cm. long, 1 mm. thick, filiform, fragile, fibrillose, *amber coloured*, shining. Gills 1 mm. wide, adnate, crowded, cream colour then tawny ochraceous. Spores tawny ochre, oval, $9\text{-}11 \times 6\text{-}7\mu$, with an apical germ pore.

On a mossy stump, pasture above Sheffield plantation, 28th of September, 1909, Docteur René Maire.

Hygrophorus pustulatus (Pers.) Fr. Epic. 325. Mon. II. 130. Ic. t. 166, f. 3. Hym. Eur. 411 and see pl. 13.

Pileus 2-5 cm. wide, fleshy, thin, convex then expanded, um-

bonate, viscid, livid grey, disc *fuscous, broken up into papillae.* Stem 3·5-4·5 cm. long, 5-13 mm. thick, stuffed, equal or fusiform, white, *rough with black points.* Gills 5-6 mm. wide, adnato-decurrent, distant, soft, white sometimes glaucous. Spores white, ovoid pruniform, 8-9 × 5μ. Smell none.

Amongst Spruce leaves, on drained ground planted with Spruce twenty years ago, Inver, Perthshire, Mr. Charles McIntosh, 6th of October, 1909.

Easily known by the black punctate stem.

Hygrophorus citrinus Rea. Vide t. 11.

Pileus 1-2 cm. latus, tenuis, e convexo planus, *citrinus, viscidus, margine striato.* Stipes 1-2 cm. longus 2-3 mm. crassus, solidus, basi attenuatus, apice albus deorsum citrinus, *viscidus.* Caro *concolor.* Lamellae 2-3 mm. latae, subconfertae, albidocitrinae, adnato-decurrentes. Sporae albae, ellipticae, 7-7·5 × 5μ, uniguttulatae.

Ad margines herbidos viarum prope Grindleford. Legit, Mrs. Carleton Rea, 27—ix.—09.

Distinguished from the other viscid species of the Hygrocybe section by the citrine yellow pileus with deeper coloured striations, the viscid, solid stem and concolourous flesh.

Lactarius fluens Boud. Bull. Soc. Myc. de Fr. XV., 49. Pl. II. and see pl. 12.

Scattered or *caespitose.* Pileus 5-10 cm. wide, fleshy, convex, scarcely flattened with age, *rough, viscid* not glutinous, *blackish olive,* either somewhat zoned or zoneless and unicolorous but always *paler ochraceous towards the margin.* Flesh white, *brown when bruised.* Stem 5-8 cm. long, 1-2 cm. thick, solid, somewhat viscid, unequal, attenuated at the base, greyish ochre and becoming brown when bruised. Gills 3-4 mm. wide, adnate or subdecurrent, *ochraceous* then cinereous ochraceous. Milk plentiful when wounded like *L. volemus,* white then *brownish,* at first mild then acrid and bitter. Spores white, round or oval, 10-11 × 7-8μ, echinulate, netted.

Amongst grass under Beeches, Chatsworth Gardens, 1st of October, 1909, Monsieur E. Peltereau.

Distinguished from *L. blennius* by its larger size, generally caespitose habit, more convex pileus which is less viscid, deeper in colour and granularly punctate on the epidermis, the abundant milk turning brownish and the larger spores. The spores in this gathering only measured 7-8 × 6μ.

Russula grisea (Pers.) Fr. Epic. 361, Hym. Eur. 451, *palumbina* Quél. Fl. Myc. 339, Bataille Fl. Mon. Astérosporés 82 and see pl. 13.

Pileus 6-9 cm. wide, fleshy, firm, convex then expanded and depressed, slightly viscid, smooth, *greyish lilac* or *bluish grey* mixed with *rose, yellow* or *olive* then *becoming greenish;* margin pruinose, even or finally slightly striate; flesh firm, elastic, soft with age, white, *lilac beneath the thin separable pellicle.* Taste mild; generally slightly acrid in the gills of young specimens. Stem 8-10 cm. long, 2-3 cm. thick, stuffed firm, *rugoso-striate, white.* Gills 8-12 mm. wide, adnate, sometimes forked, broadest towards the margin, *cream colour* with a tint of the colour of the *flesh of an apricot.* Spores *ochraceous*, eliptical, $8 \times 7\mu$, echinulate.

On the ground under Conifers, Baslow, Rev. W. L. W. Eyre and Chatsworth Gardens, Mr. D. A. Cotton and Docteur René Maire, 1st of October, 1909.

Somewhat resembling some forms of *R. cyanoxantha* (Schaeff.) Fr., but easily distinguished by its ochraceous spores.

Cantharellus amethysteus Quél. As. Fr. 1882, Fl. Myc. 37, and see pl. 12.

Pileus 5-10 cm. wide, fleshy, firm, turbinate, then plane and somewhat depressed, *egg-yellow* covered with a *lilac down*, which is either in zones or more noticeable at the margin, which is often incised. Flesh white then yellowish. Stem 3-4 cm. long, 2·5-3 cm. thick, obconic, attenuated downwards, egg-yellow. Gills ·5-1 mm. wide and thick, veinlike, branched, egg-yellow. Spores white, oval, $10 \times 5\text{-}6\mu$, filled with granular protoplasm.

On the ground amongst short grass, Chatsworth Gardens, 1st of October, 1909. C.R.

Easily recognised by the pale lilac down on the pileus.

Marasmius globularis Fr. Quél. Jur. I., 197, t. 23, f. 6, Fr. Hym. Eur. 467, and see pl. 13.

Pileus 1·5-3 cm. wide, *globose then campanulate*, hygrophanous, pellucidly striate, milk white, then shining, often tinted with rose or greyish violet and finally fuscous violaceous. Stem 2-5 cm. long, 3-4 mm. thick, fistulose, flexuose, *pulverulent, white* then brownish at the base. Gills 3-5 mm. wide, free, distant, ventricose, white, then dingy. Spores white, ovoid pruniform, $9 \times 7\mu$. Smell very pleasant, according to Quélet like that of *M. oreades.*

Amongst short grass by the roadside, Swarraton, Hants, 16th of September, 1909, Rev. W. L. W. Eyre.

It seems very probable that *M. Wynnei* B. & Br. is only an old condition of this species.

Polystictus albidus (Trog.) Fr. Hym. Eur. 567. Schaeff. t. 124.

White. Pileus 6-7 cm. broad, *corky-woody*, variable in form, globose, shell shaped, triquetrous or slightly stipitate, at first dry, like tow, and elastic, then hard and woody, *free*, *ruggedly-rugose*, *zoneless*, *obtuse at the margin*. Pores thin, minute, somewhat angular, acute, entire.

On rotten Fir trunks.

On a living tree near Grindleford railway station, 30th of September, 1909. Messieurs Charles Crossland and T. Hey. This determination was kindly furnished by Mr. C. G. Lloyd, to whom Mr. Crossland had sent the specimens.

Poria placenta Fr. Mon. II., p. 272. Icon. t. 188, f. 3. Hym. Eur. 572.

Resupinate, widely effused, rather thick, *soft*, separable; margin byssoid, sterile, white. Pores *rosy flesh colour* when moist, fuscous when dry, angular, unequal, *irregularly stratose*. Smell very pleasant. Spores white, hyaline, elliptical, $5 \times 3\mu$, minutely punctate.

On a Larch stump, Inver, Dunkeld, Perthshire, 30th August, 1909, Mr. C. McIntosh.

Easily distinguished amongst the Poriae with red tubes by its soft consistency and the irregularly stratose pores. The determination of this species was kindly made by Docteur René Maire.

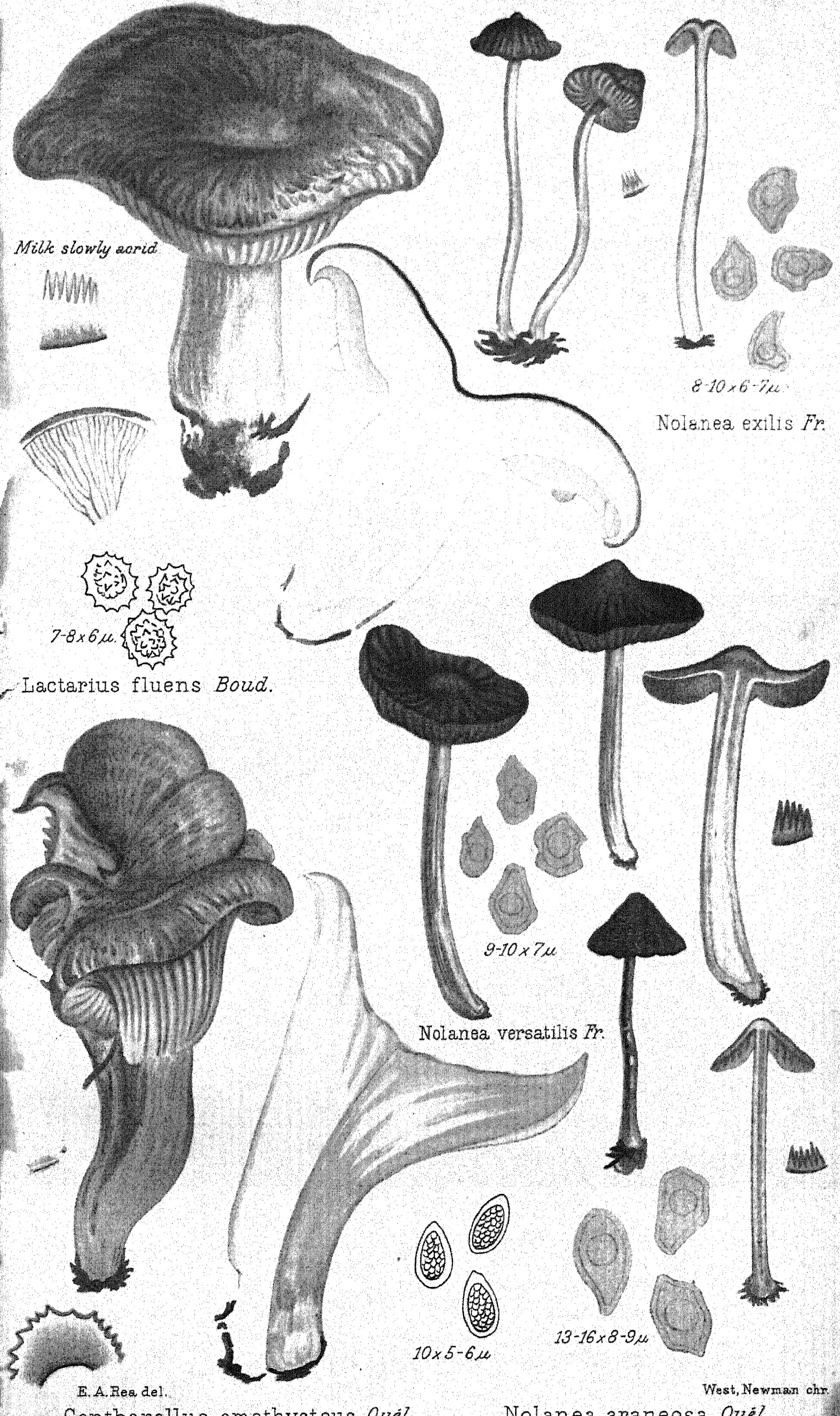
Dasycypha globuligera Fckl. (Sym. myc. Nachtr. II. 61) Rehm in Rabenhorst's Krypt-Flora I. 3, 837.

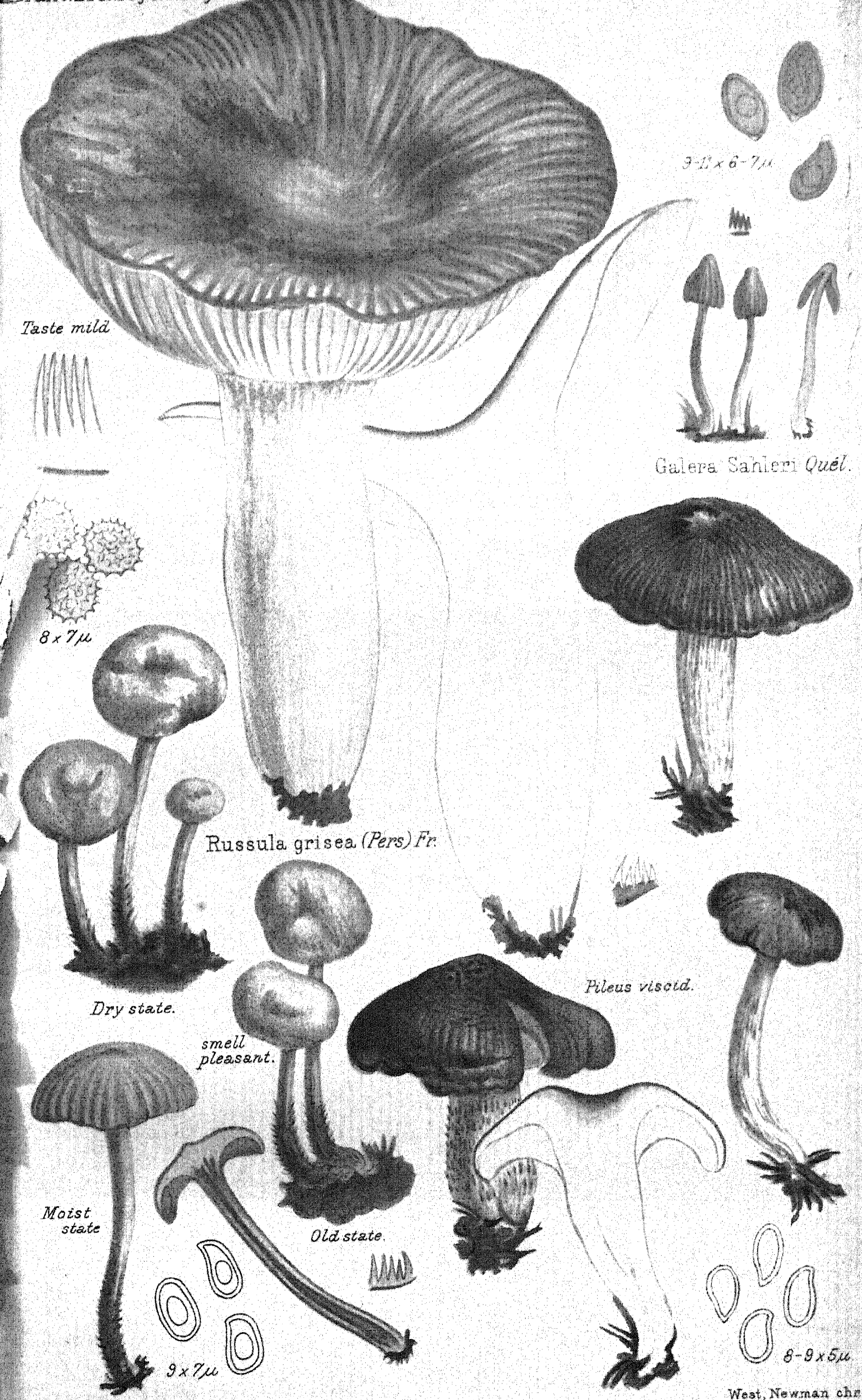
Ascophore 1-3 mm. broad, at first globose and closed then becoming cup-shaped, *with a distinct rim at the margin*, and disclosing the white hymenium which *finally becomes yellowish or brownish-yellow*. Stem 1-2 mm. high, 1-3 mm. wide, externally whitish and covered with rows of hairs. Ascus cylindrical, shortly stalked, $66\text{-}75 \times 6{\cdot}5\text{-}7\mu$, 8-spored. Spores clavate-fusiform, $8\text{-}12 \times 3\text{-}4\mu$, straight, continuous, colourless, obliquely 1-seriate. Paraphyses linear, $71\text{-}86 \times 1{\cdot}5\text{-}2\mu$, hyaline.

On dead decayed stems of Heather and Ash, Inver, Mr. Charles McIntosh, 9th January, 1909.

Oidium quercinum Thümen. Contributiones ad Floram mycologicam Lusitanicam 1878.

Very common on Oaks throughout Worcestershire in 1909 and in Wyre Forest, especially on young trees arising from old stumps.


Milk slowly acrid
7-8 x 6 µ.
Lactarius fluens *Boud.*
8-10 x 6-7 µ.
Nolanea exilis *Fr.*
9-10 x 7 µ
Nolanea versatilis *Fr.*
10 x 5-6 µ
13-16 x 8-9 µ
E. A. Rea del.
West, Newman chr.
Cantharellus amethysteus *Quél.*
Nolanea araneosa *Quél.*



Marasmius globularis *Weinm.* Hygrophorus pustulatus *(Pers) Fr.*

CHARLES BAGGE PLOWRIGHT, M.D., F.R.C.S. HON., J.P.

It is with deep regret that we have to record the death of our fellow member Dr. Charles Bagge Plowright, M.D., F.R.C.S. Hon., J.P., &c., on the 24th of April, 1910. We all deplore the loss that Science and the British Mycological Society have sustained by his decease and would tender to his widow and children our warmest sympathy in their bereavement. Dr. Plowright was born at King's Lynn on the 3rd of April, 1849. He entered the West Norfolk and Lynn Hospital as a pupil in October, 1865, and became subsequently House Surgeon, Surgeon and consulting Surgeon of that institution. He was for over thirty-two years Medical Officer of Health for Freebridge, Lynn Rural District Council, and was Hunterian Professor of Comparative Anatomy and Physiology of the Royal College of Surgeons from 1890 to 1894. As a boy, when only fourteen or fifteen years old, he commenced the study of fungi and later on when he was House Surgeon he published his *Sphaeriacei Britannici.* In 1872 he furnished a list of eight hundred *Norfolk Fungi* in the Transactions of the Norfolk and Norwich Naturalists' Society and was elected subsequently an honorary member of that Society. For many years Dr. Plowright carried on an extensive correspondence with the leading European mycologists, including Messieurs C. E. Broome, F. Currey, M. C. Cooke, W. G. Smith, Rev. M. J. Berkeley, Baron F. von Thümen, Dr. L. G. Rabenhorst, Dr. G. Winter, Dr. P. Magnus, Monsieur E. Boudier, P. A. Saccardo, &c. He was a frequent contributor to *Grevillea* and in conjunction with his friend the late W. Phillips, of Shrewsbury, they described over two hundred and ninety-six species in their papers on *New and Rare British Fungi* which appeared between 1871 and 1884. Dr. Plowright at first devoted his attention to the Pyrenomycetae, and he made a large collection of specimens and published several papers on this branch of mycology. This collection was included in his Herbarium which was acquired by the University of Birmingham shortly before his death. For over thirty years Dr. Plowright was a contributor to the *Gardeners' Chronicle*, and dealt principally with plant diseases caused by fungi. In 1891 he was one of the first persons to draw attention to the use of Bordeaux Mixture in France as a preventive against the Vine and Tomato Mildews and the Potato Disease. Dr. Plowright next turned his attention to the Uredinaceae and con-

ducted many experiments with the heteroecious species, the results of which were embodied in the papers that he contributed to the *Linnean Journal* and the *Royal Society's Proceedings*, and finally in 1889 they were published in his well known text book "*A Monograph of the British Uredineae and Ustilagineae.*" At Louth in the autumn of 1896 Dr. Plowright was one of the first members to inaugurate the formation of the British Mycological Society, and he subsequently acted as their President for the years 1898 and 1899, and he has since then given many very valuable and instructive papers in our Transactions. In addition to his interest in Botany Dr. Plowright was a keen archaeologist and the following papers were written by him for the Transactions of the Norfolk and Norwich Naturalists' Society *On Neolithic Man in West Norfolk;—On the native Dye plants of Great Britain, used by our ancestors;—On the archaeology of Woad, and the process by which its blue colour was extracted;—On the so-called Moon-dial on Saint Margaret's Church, King's Lynn;—On the origin of the Apothecaries symbols for the Scruple, Drachm and Ounce, and On the origin of the symbols formerly found on the Druggists' Show Carboys.*

OFFICERS FOR THE SEASON 1909.

President: Professor M. C. Potter, Sc.D., M.A., F.L.S., Armstrong College, Newcastle-upon-Tyne.

Vice-President: Professor R. H. Biffen, M.A., The Gables, Histon, near Cambridge.

Hon. Secretary and Treasurer: Carleton Rea, B.C.L., M.A., &c., 34, Foregate Street, Worcester.

Published 2nd May, 1910.

THE CHESTER SPRING FORAY.

13th to 17th May, 1910.

The second informal spring foray of the British Mycological Society was held at Chester under the presidentship of Mr. Harold Wager, F.R.S., F.L.S., from Friday, the 13th of May, to Tuesday, the 17th of May, 1910. The members assembled at the Blossoms Hotel, Chester, on the Friday evening, and after dinner Mr. W. B. Allen handed round for inspection specimens of *Tricholoma gambosum* Fr., *Collybia velutipes* (Curt.) Fr., *Mitrophora hybrida* (Sow.) Boud., *Peziza venosa* (Pers.) Fr. and *Peziza ampliata* (Pers.) Fr., from the neighbourhood of Benthall, and the Hon. Secretary exhibited, on behalf of their fellow member Mr. D. P. Goodwin, a fine example of *Physomitra* (=*Gyromitra*) *esculenta* (Pers.) Boud. from his garden at Oakden, Kidderminster. On the Saturday night Dr. H. Drinkwater, F.R.S. (Edin.) brought an enormous circular growth of *Fomes annosus* Fr. from Wrexham, Mr. J. Thompson a large form of *Morchella crassipes* (Pers.) Fr. from Wales, and *Polyporus sulphureus* (Bull.) Fr. and *Fomes nigricans* Fr. from Delamere Forest, and Dr. J. W. Ellis, F.E.S., handed round some excellent paintings of Agarics. Subsequently Mr. George Potts sent on from Benthall *Mitrophora hybrida* (Sow.) Boud. and *Hypholoma sublateritium* Fr.

On Saturday, the 14th of May, the portion of Delamere Forest adjacent to Delamere railway station was worked. Many specimens of *Omphalia umbellifera* (Linn.) Fr. were observed on the sides of the ditches that drained the peaty soil, whilst in the ditches themselves *Mitrula paludosa* Fr. flourished amidst the decaying leaves. One or two examples of *Collybia laxipes* Fr. were obtained, and Mr. W. B. Allen found a few sporangia of the somewhat scarce mycetozoon *Liceopsis lobata* Torrend. An early start was made on Sunday, the 15th of May, when the members booked to Cuddington station by the 8.10 a.m. train, from whence Mr. J. Thompson, of Chester, most kindly acted as their guide through the Forest. The Kennel wood was first investigated and several aethalia of *Amaurochaete atra* Rost. were boxed. The walk was then continued to Whitegate (otherwise known as New Church) Common, and amongst the rushes in a large mere many hundreds of nests of *Larus fuscus* Linn. (The Lesser Black-backed Gull) attracted attention. On Monday, the 16th of

May, the Erddig Woods, near Wrexham, were visited, under the leadership of Dr. H. Drinkwater, F.R.S. (Edin.). Here many interesting fungi were observed, including *Verpa Krombholzii* Cda. and *Mitrophora hybrida* (Sow.) Boud. gathered by Professor M. C. Potter and Dr. H. Drinkwater, and the rare mycetozoon *Margarita metallica* List. was secured by Mr. W. B. Allen. Dr. H. Drinkwater very kindly conveyed the members back to Wrexham in his motor and offered a welcome cup of tea that was greatly appreciated, and he afterwards exhibited many very beautiful and life-like paintings of our British wild flowers. On Tuesday, the 17th of May, the lovely Nantyffrith Valley, near Wrexham, was explored by the kind permission of Mr. R. H. Venables Kyrke, J.P., D.L., who most hospitably entertained the members to luncheon at his house. In the upper part of this valley an intense blue form of *Mycena Iris* Berk. was collected by Mr. W. B. Allen, and near to it Dr. H. Drinkwater found *Naucoria erinacea* Fr. growing on a twig, whilst the adjacent rushes yielded many ascophores of *Sclerotinia Curreyana* (Berk.) Karst. In the lower portion of the valley many species of mycetozoa were met with, including *Physarum straminipes* List., *Comatricha Persoonii* Rost., *Liceopsis lobata* Torrend., and *Prototrichia flagellifera* Rost.

Over two hundred species were gathered during the foray, consisting of one hundred and seventy-four fungi and twenty-six mycetozoa. Hearty votes of thanks were accorded to Mr. R. H. Venables Kyrke, J.P., D.L., and to Dr. H. Drinkwater, F.R.S. (Edin.) for their kind hospitality, and to the former for permission to visit his estate, to Messieurs J. Carter, Jonas and Son and Mr. A. Saunders for their kind permits for Delamere Forest, given on behalf of the Woods and Forest Departments of the Government, and to Mr. J. Thompson and Dr. Drinkwater for their able leadership in the field.

COMPLETE LIST OF FUNGI GATHERED DURING THE FORAY.

D. = Delamere Forest. *E.* = Erddig Woods. *N.* = Nantyffrith.

Lepiota amianthina (Scop.) Fr. *E.*
Tricholoma albobrunneum (Pers.) Fr. *E.*, gambosum Fr. *E.*
Clitocybe ditopoda Fr. *D.*
Laccaria laccata (Scop.) B. & Br. *D.*
Collybia velutipes (Curt.) Fr. *E.*, laxipes Fr. *D.*, clavus (Schaeff.) Quél. *D. E.*, conigenus (Pers.) Fr. *D.*
Mycena Iris Berk. *N.*, polygramma (Bull.) Fr. *E.*, galericulata (Scop.) Fr. *D. N.*, rugosa Fr. *E.*, metata Fr. *D.*, discopoda Lév. *N.*
Omphalia pyxidata (Bull.) Fr. *D.*, umbellifera (Linn.) Fr. *D.*, integrella (Pers.) Fr. *E.*
Pleurotus reniformis Fr. *E.*
Pluteus cervinus (Schaeff.) Fr. *E.*
Entoloma nidorosum Fr. *E.*
Nolanea pascua (Pers.) Fr. *E.*
Naucoria melinoides (Bull.) Fr. *E.*, erinacea Fr. *N.*
Galera hypnorum (Schrank) Fr. *D.*
Tubaria furfuracea (Pers.) W. G. Smith. *D. N.*, crobula Fr. *N.*
Stropharia semiglobata (Batsch) Fr. *D. E.*
Hypholoma sublateritium (Schaeff.) Fr. *D. E.*, epixanthum (Paul.) Fr. *E.*, fasciculare (Hudson) Fr. *D. E. N.*, appendiculatum (Bull.) Fr. *E. N.*
Psilocybe foenisecii (Pers.) Fr. *E. N.*
Psathyra fibrillosa (Pers.) Fr. *E.*
Panaeolus sphinctrinus Fr. *E.*, campanulatus (Linn.) Fr. *D.*
Coprinus atramentarius (Bull.) Fr. *N.*, cinereus Fr. *E.*, micaceus (Bull.) Fr. *E.*, radiatus (Bolt.) Fr. *E.*, plicatilis (Curtis) Fr. *E.*, hemerobius Fr. *D.*
Marasmius epiphyllus Fr. *D. N.*
Panus stypticus (Bull.) Fr. *D.*
Polyporus brumalis (Pers.) Fr. *N.*, squamosus (Huds.) Fr. *E.*, fumosus (Pers.) Fr. *E.*, amorphus Fr. *E.*, hispidus (Bull.) Fr. *E.*
Fomes applanatus (Pers.) Wallr. *E.*, annosus Fr. *D. E.*
Polystictus versicolor (Linn.) Fr. *D.*, hirsutus (Schrad.) Fr. *E.*, abietinus (Dicks.) Fr. *D.*
Poria vaporaria (Pers.) Fr. *D. E.*, blepharistoma B. & Br. *E.*

Ceriomyces (= Ptychogaster) albus (Cda.) Sacc. *D.*
Trametes mollis (Somm.) Fr. *D. E.*
Daedalea quercina (Linn.) Fr. *E.*
Solenia fasciculata (Pers.) Fr. *N.*, anomala (Pers.) Fr. *D. E. N.*
Hydnum farinaceum (Pers.) Fr. *E.*
Irpex obliquus (Schrad.) Fr. *D. E.*
Grandinia granulosa (Pers.) Fr. *D.*, mucida Fr. *D. E.*
Stereum hirsutum (Willd.) Fr. *E.*, ochroleucum Fr. *E.*, purpureum (Pers.) Fr. *E.*, sanguinolentum (A. & S.) Fr. *E.*, rugosum Fr. *D. E.*
Hymenochaete rubiginosa (Dicks.) Lév. *E.*, corrugata (Fr.) Lév. *N.*
Corticium lacteum Fr. *D. E.*, arachnoideum Berk. *E.*, sanguineum Fr. *D. E.*, porosum Berk. & Curt. *E.*
Peniophora quercina (Pers.) Cke. *E.*, cinerea (Pers.) Cke. *N.*, velutina (DC.) Cke. *E.*, incarnata (Fr.) Mass. *E.*
Exidia albida (Huds.) Bref. *E.*
Tremella lutescens (Pers.) Fr. *D.*, mesenterica Retz. Fr. *D.*, indecorata (Somm.) Fr. *E.*
Dacryomyces deliquescens (Bull.) Duby *D.*, stillatus (Nees) Fr. *D. E. N.*, chrysocomus (Bull.) Tul. *D.*
Sphaerobolus stellatus (Tode) Pers. *D.*
Cyathus striatus (Huds.) Pers. *E.*, vernicosus (Bull.) DC. *D.*
Bovista nigrescens Pers. *D.*
Lycoperdon caelatum (Bull.) Fr. *N.*
Ustilago violacea (Pers.) Tul., *N.*, hypodytes (Schlecht.) Fr. *D.*
Urocystis anemones (Pers.) Wint. *E.*
Uromyces ficariae (Schum.) Lév. *E.*, dactylidis Otth. *E.*, poae Rabh. *E.*, scillarum (Grev.) Wint. *E.*
Puccinia malvacearum Mont. *N.*, fusca (Relhan) Wint. *E.*, caricis (Schum.) Wint. *E.*, violae (Schum.) Wint. *E.*, adoxae DC. *E.*
Triphragmium ulmariae (Schum.) Link. *N.*
Phragmidium fragariastri (DC.) Schröt. *N.*
Melampsora rostrupii Wagner *E.*
Coleosporium senecionis (Pers.) Lév. *E. N.*
Erysiphe graminis (DC.) Fr. *N.*
Nectria cinnabarina (Tode) Fr. *D. N.*, coccinea (Pers.) Fr. *E. N.*, episphaeria (Tode) Fr. *E.*, ditissima Tul. *E.*
Hypomyces rosellus (A. & S.) Tul. *E.*
Hypocrea rufa (Pers.) Fr. *D. N.*
Chaetomium elatum Kunze.
Leptospora ovina (Pers.) Fckl. *N.*
Melanomma pulvis-pyrius (Pers.) Fckl. *D. E. N.*
Sphaerella hedericola (Desm.) Cke. *N.*, buxi Fckl. *E.*
Guinardia punctoidea (Cke.) Schröt. *N.*
Leptosphaeria acuta (Moug. & Nestl.) Karst. *N.*
Chaetosphaeria phaeostroma (Dur. & Mont.) Fckl. *D.*

Valsa (Eutypa) lata (Pers.) Nitschke. *E.*
Quaternaria Persoonii Tul. *E. N.*
Diatrypella quercina (Pers.) Nitschke *E.*
Diatrype stigma (Hoffm.) Fr. *E. N.*, disciformis (Hoffm.) Fr. *E.*
Hypoxylon fuscum (Pers.) Fr. *D. N.*, coccineum (Bull.) Fr. *N.*
Ustulina vulgaris Tul. *E.*
Xylaria hypoxylon (Linn.) Grev. *D. E. N.*, carpophila (Pers.) Fr. *E.*
Phyllachora junci (Fr.) Fckl. *N.*
Rhopographus pteridis (Sow.) Wint. *D. N.*
Mitrula paludosa Fr. *D.*
Mitrophora hybrida (Sow.) Boud. *E.*
Verpa Krombholzii Cda. *E.*
Humaria granulata (Bull.) Quél. *E. N.*
Dasyscypha virginea (Batsch.) Fckl. *D.*, nivea (Hedw. fil) Mass. *N.*, acutipila (Karst.) Sacc. *E.*, bicolor (Bull.) Fckl. *E. N.*, aspidiicola (B. & Br.) Sacc. *E.*, hyalina (Pers.) Mass. *D.*, calycina (Schum.) Fckl. *N.*
Lachnea coprinaria (Cke.) Phil. *E.*, scutellata (Linn.) Gill. *E.*
Sclerotinia Curreyana (Berk.) Karst. *N.*
Helotium virgultorum (Vahl.) Karst. *E.*, herbarum (Pers.) Fr. *D. N.*, fagineum (Pers.) Fr. *E.*
Belonidium pruinosum (Jerdon) Rehm. *E.*
Mollisia cinerea (Batsch) Karst. *D. E. N.*, melaleuca (Fr.) Sacc. *D. E.*, dentata (Pers.) Gillet. *D.*, filicum Phil. *E.*
Orbilia xanthostigma Fr. *E. N.*
Cenangium furfuraceum (Roth.) de Not. *N.*
Rhytisma acerinum (Pers.) Fr. *D. E. N.*
Trochila ilicis (Chev.) Crouan. *D. E.*
Phacidium multivalve Kze & Schmidt. *D. E.*
Cystopus candidus (Pers.) Lév. *E.*
Plasmopara pygmaea Schröt. *E.*
Rhinotrichum aureum Cke. & Mass. *E.*
Sporotrichum aurantiacum Grev. *E.*
Botrytis vulgaris Fr. *N.*, cinerea (Pers.) Fr. *D.*
Sepedonium chrysospermum (Bull.) Fr. *Kennel Wood. E.*
Ramularia pratensis Sacc. *D.*
Bispora monilioides Cda. *N.*
Brachysporium apicale (B. & Br.) Sacc. *E.*
Fumago vagans Pers. *N.*
Stilbum tomentosum Schr. *E.*
Graphium flexuosum Sacc. *D.*
Bactridium flavum K. & S. *E.*
Frankiella alni (Wor.) Maire. *D.*

*Mycetozoa.**

Badhamia utricularis Berk. *N.*, panicea Rost. *E.*
Physarum nutans Pers. *E.*, straminipes List. *N.*
Leocarpus vernicosus Link. *N.*
Didymium farinaceum Schrad. *D.*, effusum Link. *D.* *Newchurch, near Cuddington.*
Comatricha obtusata Preuss. *D. E.*, Persoonii Rost. *N.*
Amaurochaete atra Rost. *D.* *Kennel Wood, near Cuddington.*
Cribraria rufescens Pers. *D.*
Dictydiaethalium plumbeum Rost. *E.*
Reticularia lycoperdon Bull. *D. E. N.*
Liceopsis lobata Torrend. *D. N.*
Trichia affinis de Bary. *E.*, scabra Rost. *E.*, varia Pers. *D. E.*, fallax Pers. *E.*, botrytis Pers. *D.*
Arcyria ferruginea Sauter. *D.*, punicea Pers. *E.*, incarnata Pers. *E.*
Perichaena populina Fr. *N.*
Margarita metallica List. *E.*
Prototrichia flagellifera Rost. *N.*
Lycogala miniatum Pers. *E. N.*

*These were kindly determined by our member Mr. W. B. Allen and verified by Miss Gulielma Lister, F.L.S.

THE WREXHAM FORAY.

26th September to the 1st October, 1910.

The fourteenth annual week's fungus foray of the British Mycological Society was held in the vicinity of Wrexham. On Monday, the 26th of September, 1910, the members assembled at the headquarters, The Imperial Hotel, Wrexham, where the ball-room was placed at their disposal for the exhibition of fungi and the reading of papers, whilst a small drawing-room was also reserved for the microscopic investigation of the mycetozoa and micro-fungi. During the evening the following fungi were placed out on exhibition. *Thelephora anthocephala* (Bull.) Fr., *Thelephora palmata* (Scop.) Fr., *Lenzites sepiaria* (Wulf.) Fr. and *Trametes inodora* Fr. collected by Professor M. C. Potter in Switzerland. *Trametes rubescens* (A. & S.) Fr., sent by the Rev. W. L. W. Eyre, from Swarraton. *Xylaria polymorpha* (Pers.) Grev. consigned by Dr. A. Adams from Savernake Forest. *Nyctalis parasitica* (Bull.) Fr., brought by Mr. Raymond Finlayson. *Pholiota squarrosa* (Müll.) Fr., *Stropharia caput-Medusae* Fr., *Pleurotus corticatus* Fr. (*On Walnut*), *Gomphidius viscidus* Fr., *Cortinarius (Phlegmacium) dibaphus* Fr., *Lactarius helvus* Fr., *Polyporus rufescens* (Pers.) Fr., collected by the Hon. Secretary at Kyre Park, Worcestershire, and also *Flammula conissans* Fr. from Dodderhill Common, Worcestershire. Mr. D. Mackenzie also brought in a specimen of the somewhat rare *Polyporus quercinus* (Schr.) Fr. that he had gathered that day in the grounds of Eaton Hall, near Chester. After these specimens had been inspected, Mr. H. Hamshaw Thomas, The Botany School, Cambridge, was unanimously elected a member.

On Tuesday, the 27th of September, the members booked by the 9.28 train to Llangollen station, where brakes were in waiting and conveyed them by a very picturesque drive via Valle Crucis Abbey up a very steep wooded valley to the World's End. Near to a fine black and white house, known as Plas Uchaf (where Queen Elizabeth in former days has stayed), the members left the brakes, and under the kind conductorship of Dr. H. Drinkwater and Mr. J. Thompson, of Chester, proceeded to explore the recesses of this rugged and wild district. The most noteworthy fungi collected during the day were *Mycena elegans* (Pers.) Fr., *Naucoria effugiens* Quél., *Gomphidius gracilis* Berk., *Hygrophorus mesotephrus* Berk., *Hygrophorus Reai* Maire, *Russula citrina* Gillet, *Russula azurea* Bres., *Boletus porphyrosporus* Fr., *Polyporus umbellatus* (Pers.)

Fr., *Clavaria argillacea* (Pers.) Fr., and *Geoglossum difforme* Fr. The plasmodium of *Fuligo muscorum* A. & S. covered the hillside in many places, and although whilst in this condition it is a very noticeable object, running over the heather and mosses, it takes a keen eye to detect it in its perfect condition. The other Mycetozoa collected included *Stemonitis flavogenita* Jahn, *Trichia scabra* Rost. and *Comatricha typhoides* Rost.

In the evening, at nine o'clock, the President (Mr. Harold Wager, F.R.S., F.L.S.) took the chair, and the following officers were unanimously elected for the ensuing year:—Professor E. S. Salmon, F.L.S., President; Professor M. C. Potter, Sc.D., M.A., F.L.S., Vice-President; and Mr. Carleton Rea, B.C.L., M.A., &c., Hon. Secretary and Treasurer. The Hon. Secretary reported that he had received an invitation from the Somersetshire Archæological and Natural History Society to visit their county with Taunton as their headquarters, and that their member, Mr. E. W. Swanton, who had arranged so successfully the Haslemere foray, would prospect and conduct them to suitable woods and commons in the neighbourhood. This proposal was unanimously accepted, and the date was left open so as not to clash, if possible, with the forays of the Yorkshire Naturalists Union or The Cryptogamic Society of Scotland, but that the latest date must be not later than the last week in September, because some of the members are obliged to get back to their professional work by the first week in October.* Mr. D. A. Boyd wrote proposing a joint meeting with the Cryptogamic Society of Scotland for the season 1912, and it was resolved that the Society would be pleased to consider such a proposal at the next meeting at Taunton, but that each Society should be represented by its own officers at the joint meeting. The President was appointed the delegate to represent the British Mycological Society at the meeting of the British Association in 1911, and the subject selected for discussion thereat "The best means of popularizing the study of our larger fungi with special reference to their edible and poisonous qualities."

It was also resolved that a spring foray should be held in 1911 at Whitsuntide, and that Teesdale should be worked with Rokeby or High Force as a centre. The Hon. Treasurer reported that their credit balance at the post office savings bank only amounted to £13. 6s. 6d., and that eleven new members had been elected since their last autumn foray, namely, Dr. Henry Drinkwater, M.D., F.R.S. Edin., Grosvenor Lodge, Wrexham; Professor W. H. Lang, M.B., D.Sc., 2, Heaton Road, Withington, Manchester; Mrs. Cecily D. Harvey, Barwick in Elmet Rectory, near Leeds; Dr. John W. Ellis, F.E.S., 78, Rodney Street, Liverpool; Mr. Raymond Finlayson, The Seed Testing Laboratory, Wood Green, London, N.; Mr. George

*The date is now fixed for Monday, the 18th of September, to Saturday, the 23rd September, 1911.

Potts, Benthall House, Broseley, Salop; Mr. Theodore George Bentley Osborn, B.Sc., The Victoria University, Manchester; Mr. F. T. Brooks, M.A. (Senior Demonstrator of Botany, Cambridge University), The Botany School, Cambridge; Miss Beatrice Katherine Taylor, 98, Cheyne Walk, Chelsea, S.W.; Mr. Charles Otto Blagden, The Sports Club, Saint James Square, London, S.W.; and Mr. J. Ramsbottom, B.A., British Museum, Cromwell Road, South Kensington.

On Wednesday, the 28th of September, the forenoon was devoted to the determination of the fungi gathered on the previous day, and at 12 o'clock the members were driven from the headquarters to Erbistock Ferry. Here the woods on both sides of the river Dee were very carefully investigated, but fungi were scarce, and those of chief interest were the following:—*Pluteus salicinus* (Pers.) Fr., *Entoloma pulvereum* Rea, *Naucoria effugiens* Quél., *Cortinarius (Phlegmacium) caerulescens* (Schaeff.) Fr., *Russula azurea* Bres., and *Clavaria Kunzei* Fr. In the Flintshire portion of the woods the second British record for *Chondrioderma globosum* Rost. was obtained by Mr. W. B. Allen on decaying leaves of *Carex*.

In the evening, after the Club dinner, at nine o'clock, Mr. Harold Wager, F.R.S., F.L.S., delivered his presidential address entitled "Morphological and Physiological aspects of the study of fungi." (See page 250.)

On Thursday, the 29th of September, the morning was devoted to book work and the microscope until mid-day, when the trams were taken to near the outskirts of the Erddig Woods. Here the trams were left and the members explored the woods in different directions. Miss Gulielma Lister found some nice examples of *Marasmius archyropus* (Pers.) Fr. var. *suaveolens* Rea, first recorded from Grange Park, Swarraton, and now in this locality. *Pleurotus ulmarius* (Bull.) Fr. was found growing on beech, and *Pluteus salicinus* (Pers.) Fr. was again met with and in close proximity thereto *Caldesiella ferruginosa* (Fr.) Sacc., and *Marasmius alliaceus* (Jacq.) Fr.

In the evening, at nine o'clock, Mr. W. Norwood Cheeseman, J.P., F.L.S., exhibited his collection of Mycetozoa gathered by him in the Rocky Mountains last year, on the occasion of his visit to Winnipeg in connection with the meeting of The British Association held there in 1909. These have been all duly determined by Miss Gulielma Lister, F.L.S., and his remarks thereon he has kindly embodied in a paper (see page 267). Professor M. C. Potter, Sc.D., M.A., F.L.S., followed with a short account of his recent researches upon the electric current developed by Fungi and Bacteria and described an ingenious method by means of which he demonstrated that the breaking down of all organic compounds by micro-organisms is accompanied by the

liberation of electrical energy. The apparatus consisted of a large test-tube containing a porous cylinder, and into each of these was placed a nutrient medium and also a platinum electrode. Various species of *Bacteria* and *Saccharomyces cerevisiae* introduced into either the porous cylinder or the test tubes, set up chemical processes which caused the fluid in which they were placed to act as the zinc of an ordinary battery. The electromotive force was measured by using a condenser and galvanometer, and in the case of platinum electrodes this was found to vary from ·3 to ·5 volts according to the organism and culture medium.

Hearty votes of thanks were then passed, on the proposition of the President, to the landowners and tenants of the various properties and estates visited, to Dr. H. Drinkwater and Mr. Joseph Thompson, of Chester, for all the care and trouble that they had taken in selecting favourable localities for their inspection, and to their hardy perennial, their Hon. Secretary and Treasurer, for all the care that he took in the Society's welfare, and it was resolved to include in that vote his wife, who did such excellent work on their behalf with her brush and pencil.

On Friday, the 30th of September, the Secretary received a fine example of *Hydnum compactum* (Pers.) Fr., gathered in Rothiemurchus Forest by a fellow member, Mr. Angus Grant. Few critical species remained to be examined this morning, so it was resolved to catch the 11.47 train for Ruabon. On arrival there, Wynnstay Park and its adjacent woods were carefully explored, but although the part round and near to the Bath ground had an abundance of old fallen timber, little of interest could be found by the mycologists, whereas those in search of mycetozoa found many interesting species, including *Didymium crustaceum* Fr. and *Dictydiaethalium plumbeum* Rost.

Mr. C. O. Blagden found a fine group of *Polyporus umbellatus* (Pers.) Fr.; and a portion of this was sampled at breakfast on the following morning, when the flavour was considered very nice but its consistency was found to be rather tough. The more uncommon fungi met with during the day were *Russula chamaeleontina* Fr. and *Mycena rubella* Quél. A *Fomes* was gathered on an old Oak tree in Wynnstay Park, that is used as a station from which to shoot the Deer, and this was subsequently determined by a member, Mr. C. G. Lloyd, after consultation with L'Abbé G. Bresadola, to be *Ganoderma resinaceum* Boud.

About three hundred and fifty-nine species of fungi and forty-two species and two varieties of mycetozoa were collected during the foray. This record for the mycetozoa is the largest the Society has ever had but that for the fungi is very small, indeed the Basidiomycetae seem nowhere to have grown in any abundance during the autumn of 1910.

COMPLETE LIST OF FUNGI GATHERED DURING THE FORAY.

Those species that were only noted at one or two of the stations are marked *W*. Worlds End; *Erb*. Erbistock; *Erd*. Erddig, and *Wn*. Wynnstay.

Amanita phalloides (Vaill.) Fr., *Erb*., *Erd*., mappa (Batsch) Fr., muscaria (Linn.) Fr., rubescens Fr.

Amanitopsis vaginata (Bull.) Roze *Erb*. var. fulva (Schaeff.) W. G. Sm. *Erb*.

Lepiota rachodes (Vitt.) Fr., *Erd*., cristata (A. & S.) Fr., *Erd*., carcharias (Pers.) Fr., *W*., amianthina (Scop.) Fr., *W*.

Armillaria mellea (Vahl.) Fr.

Tricholoma resplendens Fr., *W*. *Wn*., albobrunneum (Pers.) Fr., rutilans (Schaeff.) Fr., vaccinum Fr., *W*., terreum (Schaeff.) Fr., argyraceum (Bull.) Fr. var. chrysites Jungh., saponaceum Fr., cuneifolium Fr., *Erb*., *Erd*., and var. cinereo-rimosum (Batsch) Fr. *Erb*., virgatum Fr., melaleucum (Pers.) Fr. *W*., sordidum (Schum.) Fr., *W*., lilaceum Quél., *Erd*.

Clitocybe nebularis (Batsch) Fr., *W*., rivulosa (Pers.) Fr., cerussata Fr., candicans (Pers.) Fr., infundibuliformis (Schaeff.) Fr., metachroa Fr., *W*., ditopoda Fr., *W*., fragrans (Sow.) Fr., *Wn*.

Laccaria laccata (Scop.) B. & Br., var. amethystina (Vaill.) B. & Br.

Collybia radicata (Relh.) Fr., longipes (Bull.) Fr., *Erb*., platyphylla Fr., *Erd*. var. repens (Ach.) Fr. *Erd*., fusipes (Bull.) Fr., *Erb*., *Erd*., *Wn*., maculata (A. & S.) Fr., *W*., butyracea (Bull.) Fr., *W*., *Wn*., velutipes (Curt.) Fr., *Erb*., vertirugis Cke., *Erb*., confluens (Pers.) Fr., *Erd*., *Wn*., conigena (Pers.) Fr., acervata Fr., *Erb*.

Mycena elegans (Pers.) Fr., *W*., pura (Pers.) Fr., rubella Quél., *Erd*., *Wn*., lactea (Pers.) Fr., *W*., rugosa Fr., galericulata (Scop.) Fr., polygramma (Bull.) Fr., pullata Berk. & Cke., *W*., alcalina Fr., *Wn*., ammoniaca Fr., plicosa Fr., *Wn*., metata Fr., *W*., *Erd*., *Wn*., filopes (Bull.) Fr., *Erd*., amicta Fr., sanguinolenta (A. & S.) Fr., galopoda (Pers.) Fr., leucogala Cke., epipterygia (Scop.) Fr., *W*., vulgaris (Pers.) Fr., *W*., discopoda Lév., tenerrima Berk., *Erd*., corticola (Schum.) Fr., *Wn*., capillaris (Schum.) Fr.

Omphalia rustica Fr., *W*.

Pleurotus corticatus Fr., *W*., *Erb*., ulmarius (Bull.) Fr., *Erd*., *On Beech;* reniformis Fr., *Wn*.

Pluteus cervinus (Schaeff.) Fr., salicinus (Pers.) Fr., *Erb.*, *Erd.*, nanus (Pers.) Fr., *W.* (a very small form).
Entoloma pulvereum Rea, *Erb.*, griseocyaneum Fr., *Erb.*, sericeum (Bull.) Fr., *W.*
Nolanea pascua (Pers.) Fr., pisciodora (Ces.) Fr., *W.*
Claudopus variabilis (Pers.) W. G. Sm., *Erb.*, *Erd.*, *Wn.*
Pholiota togularis (Bull.) Fr., *Erb.*, squarrosa (Müll.) Fr., *W.*, *Wn.*, mutabilis (Schaeff.) Fr.
Inocybe pyriodora (Pers.) Fr., *Wn.*, rimosa (Bull.) Fr., eutheles B. & Br., *W.*, fastigiata (Schaeff.) Fr., *W.*, asterospora Quél., *W.*, *Wn.*, geophylla (Sow.) Fr., *Erb.*, *Erd.*, *Wn.*
Hebeloma fastibile Fr., *W.*, mesophaeum Fr., *W.*, *Wn.*, crustuliniforme (Bull.) Fr., *Erd.*
Flammula inopoda Fr., scamba Fr., *W.*, *Erb.*
Naucoria escharoides Fr., *W.*, *Erb.*, *Wn.*, effugiens Quél., *W.*, *Erb.*
Galera hypnorum (Schrank) Fr.
Tubaria furfuracea (Pers.) W. G. Sm., crobula Fr., *W.*
Crepidotus mollis (Schaeff.) Fr.
Psaliota campestris (Linn.) Fr., var. silvicola (Vitt.) Fr., haemorrhoidaria Kalchbr. *W.*, *Erb.*
Stropharia aeruginosa (Curt.) Fr., albocyanea (Desm.) Fr., *W.*, inuncta Fr., *W.*, *Erd.*, melasperma (Bull.) Fr., *W.*, squamosa Fr., *Wn.*, stercoraria Fr., semiglobata (Batsch) Fr., caput-Medusae Fr., *W.*
Hypholoma sublateritium (Schaeff.) Fr., capnoides Fr., epixanthum (Paul.) Fr., fasciculare (Huds.) Fr., dispersum Fr., pyrotrichum (Holmsk.) Fr., *W.*, appendiculatum (Bull.) Fr., hydrophilum (Bull.) Fr.
Psilocybe sarcocephala Fr., *W.*, *Erd.*, semilanceata Fr., foenisecii (Pers.) Fr., *W.*
Psathyra corrugis (Pers.) Fr., fibrillosa (Pers.) Fr., *W.*, *Erd.*
Anellaria separata (Linn.) Karst., *W.*
Panaeolus campanulatus (Linn.) Fr., papilionaceus (Bull.) Fr., *W. Erb.*
Psathyrella gracilis (Pers.) Fr., atomata Fr., disseminata (Pers.) Fr.
Coprinus comatus Fl. Dan., *Wn.*, atramentarius (Bull.) Fr., cinereus Fr., niveus (Pers.) Fr., micaceus (Bull.) Fr., lagopus Fr. *Erd.*, *Wn.*, plicatilis (Curt.) Fr., hemerobius Fr., *Wn.*
Bolbitius titubans (Bull.) Fr.
Cortinarius (Phlegmacium) varius (Schaeff.) Fr., caerulescens (Schaeff.) Fr., decolorans (Pers.) Fr.
(Myxacium) elatior Fr.
(Inoloma) alboviolaceus (Pers.) Fr.
(Dermocybe) lepidopus Cke., cinnamomeus (Linn.) Fr.

(Telamonia) torvus Fr. *W.*, hinnuleus (Sow.) Fr., paleaceus (Weinm.) Fr.
(Hydrocybe) erythrinus Fr., *Erb.*, acutus (Pers.) Fr.
Gomphidius viscidus (Linn.) Fr., *W.*, gracilis Berk., *W.*
Paxillus involutus (Batsch) Fr., *W.*, *Wn.*
Hygrophorus (Limacium) cossus (Sow.) Fr., *Erd.*, hypothejus Fr., *W.*, mesotephrus Berk., *W.*
(Camarophyllus) pratensis (Pers.) Fr., virgineus (Wulf.) Fr., var. roseipes Mass., *W.*, niveus (Scop.) Fr., irrigatus (Pers.) Fr., *W.*
(Hygrocybe) laetus (Pers.) Fr., *W.*, *Wn.*, ceraceus (Wulf.) Fr., coccineus (Schaeff.) Fr., miniatus Fr., Reai Maire, *W.*, puniceus Fr., obrusseus Fr., *Erb.*, intermedius Pass, *Erd.*, conicus (Scop.) Fr., calyptraeformis Berk., *Wn.*, chlorophanus Fr., psittacinus (Schaeff.) Fr., unguinosus Fr., *Erd.*, *Wn.*
Lactarius (Piperites) pubescens Fr., blennius Fr., pyrogalus (Bull.) Fr., *Erb.*, vellereus Fr., *Wn.*
(Dapetes) deliciosus (Linn.) Fr., *W.*, *Erd.*
(Russularia) pallidus (Pers.) Fr., *Erd.*, *Wn.*, quietus Fr., aurantiacus (Fl. Dan.) Fr., *W.*, vietus Fr., *Erb.*, rufus (Scop.) Fr., glyciosmus Fr. *W.*, fuliginosus Fr., *Wn.*, subdulcis (Bull.) Fr.
Russula (Compactae) nigricans (Bull.) Fr., adusta (Pers.) Fr., chloroides (Krombh.) Bres.
(Furcatae) olivascens Fr., *Wn.*, furcata (Pers.) Fr., depallens (Pers.) Fr., *Wn.*
(Rigidae) lactea (Pers.) Fr., virescens (Schaeff.) Fr., *Wn.*, lepida Fr., *Wn.*, rubra (DC.) Fr., xerampelina (Schaeff.) Fr.
(Heterophyllae) cyanoxantha (Schaeff.) Fr., consobrina Fr., var. sororia (Larbr.) Fr., *Erd.*, fellea Fr.
(Fragiles) azurea Bres., ochroleuca (Pers.) Fr., granulosa Cke., *Erd.*, *Wn.*, citrina Gillet, *W.*, *Wn.*, fragilis (Pers.) Fr., var. violacea Cke., chamaeleontina Fr. *Wn.*
Cantharellus aurantiacus (Wulf.) Fr., *W.*
Nyctalis parasitica (Bull.) Fr., *Erd.*
Marasmius peronatus (Bolt.) Fr., archyropus (Pers.) Fr., var. suaveolens Rea, *Erd.*, ramealis (Bull.) Fr., alliaceus (Jacq.) Fr., *Erd.*, rotula (Scop.) Fr., androsaceus (Linn.) Fr., epiphyllus Fr.
Panus stypticus (Bull.) Fr., *W.*
Lenzites betulina (Linn.) Fr.
Boletus elegans (Schum.) Fr., *W.*, *Erd.*, piperatus (Bull.) Fr., *W.*, chrysenteron (Bull.) Fr., *W.*, subtomentosus (Linn.) Fr., pruinatus Fr., impolitus Fr., *Erb.*, porphyrosporus Fr., *W.*

Fistulina hepatica (Huds.) Fr.
Polyporus squamosus (Huds.) Fr., umbellatus (Pers.) Fr., *W.*, *Wn.*, giganteus (Pers.) Fr., fragilis Fr., *W.*, caesius (Schrad.) Fr., *W.*, mollis (Pers.) Fr., *W.*, chioneus Fr., rutilans (Pers.) Fr., adustus (Willd.) Fr., dryadeus (Pers.) Fr., betulinus (Bull.) Fr.
Fomes applanatus (Pers.) Wallr., *Erd.*, fomentarius (Linn.) Fr., *Erd.*, *Wn.*, igniarius (Linn.) Fr., *Wn.*, pomaceus (Pers.) Fr., *W.*, resinaceus (Boud.), annosus Fr.
Polystictus perennis (Linn.) Fr., versicolor (Linn.) Fr., hirsutus (Schrad.) Fr., *W.*, *Wn.*, abietinus (Dicks.) Fr., *W.*
Poria mollusca (Pers.) Fr., medulla-panis (Pers.) Fr., *Erd.*, mucida Fr., *Wn.*, ferruginosa (Schrad.) Fr., terrestris (DC.) Fr., *Erd.*
Ceriomyces (= Ptychogaster) albus (Cda.) Sacc., *W.*
Trametes mollis (Somm.) Fr., *W.*, *Erd.*, serpens Fr., *Erd.*
Daedalea quercina (Linn.) Fr.
Merulius molluscus Fr. *W.*
Solenia anomala (Pers.) Fr., *Wn.*
Hydnum ochraceum Gmel., *Erb.*, niveum (Pers.) Fr., *Erb.*
Caldesiella ferruginosa (Fr.) Sacc., *Erd.*
Irpex obliquus (Schr.) Fr.
Phlebia merismoides Fr.
Grandinia granulosa (Pers.) Fr., mucida Fr.
Sebacina incrustans (Pers.) Tul., *Erd.*
Stereum hirsutum (Willd.) Fr., ochroleucum Fr., *W.*, rugosum (Pers.) Fr.
Hymenochaete rubiginosa (Dicks.) Lév.
Corticium lacteum Fr., laeve (Pers.) Fr., caeruleum (Schr.) Fr., *Erb.*, calceum (Pers.) Fr., *Erb.*, *W.*, *Wn.*, nudum Fr.
Peniophora quercina (Pers.) Cke., *Wn.*, gigantea (Pers.) Cke., *W.*, *Erd.*, *Wn.*, cinerea (Pers.) Cke., *Erb.*, *Erd.*
Coniophora puteana (Schum.) Fr., *Erd.*
Clavaria muscoides (Linn.) Fr., *Erd.*, cinerea (Bull.) Fr., cristata (Pers.) Fr., rugosa (Bull.) Fr., *W.*, *Erd.*, Kunzei Fr., *Erb.*, stricta (Pers.) Fr., *Erd.*, *Wn.*, fusiformis (Sow.) Fr., *W.*, dissipabilis Britz., vermicularis (Scop.) Fr., argillacea (Pers.) Fr., *W.*
Calocera viscosa (Pers.) Fr., stricta Fr., W.
Typhula erythropus (Pers.) Fr.
Hirneola Auricula-Judae (Linn.) Fr., *Erb.*
Tremella sarcoides Sm.
Dacryomyces deliquescens (Bull.) Duby, stillatus (Nees) Fr.
Ithyphallus impudicus (Linn.) Fisch., *Erd.*
Mutinus caninus (Huds.) Fr., *W.*
Cyathus striatus (Huds.) Pers., *Erd.*
Bovista nigrescens Pers., *W.*

Lycoperdon perlatum Pers., *Wn.*, hyemale (Bull.) Fr., caelatum (Bull.) Fr., *Wn.*, pyriforme (Schaeff.) Pers. var. excipuliforme Desm., umbrinum Pers., *W.*
Scleroderma vulgare Hornem, *Wn.*
Sphaerobolus stellatus (Tode) Pers.
Puccinia lychnidearum Link., circaeae Pers.
Phragmidium violaceum (Schultz.) Wint., *Erb.*
Coleosporium senecionis (Pers.) Fr.
Sphacelotheca hydropiperis (Schum.) de Bary, *Erb.*
Urocystis anemones (Pers.) Wint., *Erd.*
Sphaerotheca pannosa Lév., *Erb.*
Erysiphe Martii Lév. *On Hypericum.*
Nectria cinnabarina (Tode) Fr., coccinea (Pers.) Fr., episphaeria (Tode) Fr.
Hypocrea rufa (Pers.) Fr., *Wn.*
Chaetosphaeria phaeostroma (Dur. & Mont.) Fckl.
Rosellinia aquila de Not.
Melanomma pulvis-pyrius (Pers.) Fckl.
Diaporthe crustosa Sacc. & Roum., *Erb.* *On Holly.*
Diatrype stigma (Hoffm.) Fr., disciforme (Hoffm.) Fr., *Erd.*
Quaternaria Persoonii Tul., *Erb.*
Hypoxylon multiforme Fr., fuscum (Pers.) Fr., coccineum Bull. with conidial form *Isaria umbrina* Pers., *Wn.*
Daldinia concentrica (Bolton) Ces. & de Not., *Wn.*
Xylaria hypoxylon (Linn.) Grev., polymorpha (Pers.) Grev., *Wn.*
Helvella crispa (Scop.) Fr., *W.*
Geoglossum difforme Fr., *W.*
Otidea onotica (Pers.) Fckl., *Wn.*
Lachnea scutellata (Linn.) Gill.
Sphaerospora asperior Sacc.
Helotium fagineum (Pers.) Fr., citrinum (Hedw.) Fr., *Erb.*
Mollisia cinerea (Batsch) Karst.
Orbilia xanthostigma Fr., *Wn.*
Coryne sarcoides (Jacq.) Tul., *W.*, *Erb.*
Bulgaria polymorpha (Oeder.) Wetts., *Erb.*, *Wn.*
Trochila ilicis (Chev.) Crouan., *Wn.*
Rhytisma acerinum (Pers.) Fr.
Synchytrium aureum Schröt. *On Plantago media.*
Monilia fructigena Pers. *On Plums.*
Cylindrium griseum Bon. *On Oak-leaves.*
Oidium alphitoides Griff. & Maulb., *Erb.*
Botryosporium pulchrum Cda., *Erd.*
Ramularia calcea Ces., *Erb.*, *Erd.*, *Wn.* *On Nepeta glechoma.*
pratensis Sacc. *On Rumex.*
Sphaeropsis ulmi Karst.
Melanconium elevatum Cda. *On Oak.*

LIST OF MYCETOZOA.

By Miss Gulielma Lister, F.L.S.

Ceratiomyxa mucida Schroet.
Badhamia panicea Rost.
Physarum viride Pers.
P. nutans Pers.
P. nutans subsp. *leucophaeum* Lister.
P. cinereum Pers.
P. Diderma Rost.
P. contextum Pers.
Fuligo septica Gmel.
F. muscorum Alb. & Schw. Found abundantly, chiefly in the form of apricot-coloured plasmodium, on grass and moss at the World's End, near Llangollen. The mature aethalia are ochraceous-grey and very inconspicuous and may easily be overlooked. This species was first recorded from Britain in the year 1900. Since then it has been found in the counties of Devon, Surrey, Essex, Herts, Beds, Derbyshire, Salop, and now in Denbighshire.
Leocarpus vernicosus Link.
Craterium pedunculatum Trentep.
C. leucocephalum Ditm.
C. mutabile Fr.
Chondrioderma Michelii Rost.
C. spumarioides Rost.
C. globosum Rost. This appears to be the second British gathering of the species that we know of, the first having been made by Mr. James Saunders, near Holt, Norfolk, in 1907. The present specimen has none of the thick white hypothallus usually characterizing *C. globosum.* The species is closely allied to *C. spumarioides*, differing in the eggshell-like outer sporangium-wall separating freely from the membranous inner wall, and by the larger darker spores.
Diachaea elegans Fr.
Didymium difforme Duby.
D. farinaceum Schrad.
D. farinaceum var. *minus* Lister.
D. nigripes Fr.
D. effusum Link.

D. crustaceum Fr. This handsome species is not common in Britain and seems to have been recorded hitherto from Devon, Dorset and Hants only.
Stemonitis fusca Roth.
S. flavogenita Jahn.
S. ferruginea Ehrenb.
Comatricha typhoides Rost.
C. obtusata Preuss.
C. Persoonii Rost.
C. Persoonii var. *tenerrima* Lister.
Cribraria argillacea Pers.
Dictydiaethalium plumbeum Rost.
Reticularia Lycoperdon Bull.
Lycogala miniatum Pers.
Trichia affinis de Bary.
T. scabra Rost.
T. persimilis Karst.
T. Botrytis Pers.
T. fallax Pers.
T. varia Pers.
T. contorta Rost.
Arcyria incarnata Pers.
A. punicea Pers.
A. albida Pers.
Perichaena populina Fr.
P. depressa Lib.

PRESIDENTIAL ADDRESS.

By Harold Wager, F.R.S.

I need hardly say how much I appreciate the honour you have conferred upon me in asking me to occupy the presidential chair of your Society. I was present at the meeting of the Mycological Section of the Yorkshire Naturalists' Union on the 19th September, 1896, when the Society was founded, and I have followed with great interest its proceedings during the 14 years it has now been in existence.

Before I proceed with the special subject of my address it is fitting that I should refer to the loss sustained by us during the past year by the death of our former President, Dr. Plowright. His connection with the Society began with its inauguration in 1896, in which he took an important part, and he did much in conjunction with our Secretary, Mr. Carleton Rea, to place it on a satisfactory basis. He was a man of many interests, and an enthusiastic student of the Fungi. Through his important work on the Uredineae and Ustilagineae, especially his experimental investigations in connection with their life histories on different host plants, he was brought into relationship with Mycologists all over the world, by whom he is remembered as a man of wide knowledge and as a sympathetic and helpful colleague.

The investigation of the structure and life histories of the many and varied forms which go to make up the group of the Fungi has become of great importance in the last 25 years, not only in that utilitarian aspect of it which is bound up with plant and animal diseases of various kinds, but also in the solution of the more purely scientific problems of Biology. As a distinguished predecessor in this chair, the late Professor Marshall Ward, has said, "whether as poisons or foods, destructive moulds or fermentative agents, parasitic mildews or disease germs, the Fungi occupy more of public interest than all other Cryptogams together, the Flowering Plants alone rivalling them in this respect."

As a society, you are concerned in very large measure with that important aspect of the study of the Fungi which perhaps includes every other, commonly known as *classification*, and subsidiary to this, and not yet very perfectly or fully studied, *distribution*. As far as I am acquainted with the systematic study of the Fungi, I realize the fascinating interest awakened

by their varied forms, and their separation into well-circumscribed groups, but I am also well persuaded that a knowledge of morphological and physiological principles is of fundamental importance in this study, and I therefore offer no apology in asking your attention for a short time to a few of the many interesting problems which arise in connection with the morphology and physiology of the Fungi, especially in the light of general biological principles which are common to all living organisms.

In our studies of Science we are all to some extent philosophical. We want to know the ultimate meanings of the phenomena of life and the forms in which it is manifested. How have these forms come to be as they are? What was their origin? How are they related to one another? These and many other problems arise in the study of the Fungi, but they are not peculiar to the Fungi; they are the problems of living bodies, the problems of biology.

The study of Biology is, as Driesch points out, the most difficult of the natural sciences, partly from the complexity of the phenomena with which it deals, partly because the biologist is dependent on specific living objects as they occur in nature. He cannot produce new combinations of living matter to suit his own convenience or his own special conditions. He has to take his material as he finds it and make the best of it. Consequently his field is limited and many important biological conceptions, applicable even to the most highly developed forms of life, have been based upon the most lowly organisms because these happened to be the most suitable and convenient for the purpose.

The investigation of the physiological activities of the Fungi has in no small measure aided in the elucidation of many of the problems connected with protoplasmic activity, such as the nature of enzymes and fermentation, the constitution of organic substances, the phenomena of disease, and the problems of sexuality, variation and heredity. A Fungus is a living body or organism possessing a definite form and structure and exhibiting those varied phenomena of metabolism and growth which we associate with that mysterious force—life. We cannot, even if it were possible to arrive at any definite conclusion, discuss here the problem of the cause of these vital manifestations. No doubt, it is, as Driesch puts it, "the final object of all biology to tell us what it ultimately means to say that a body is *living* and in what sorts of relations body and life stand to one another." But whether life is to be interpreted merely as the resultant of complex chemico-physical forces, or as the expression of the activity of some other force of which we are not cognizant, we cannot say. That the phenomena of vital activity largely obey

the ordinary laws of chemistry and physics is probably true, but in the last analysis there is always something elusive, something which we cannot understand, which bars the way to any satisfactory or final explanation of the phenomena of life.

The Fungi, in common with all other plants as well as animals, have as their fundamental unit of structure the cell. This consists essentially of a slimy substance, the protoplasm, in which all the manifestations of vital energy occur. The fundamental idea of the cell theory as promulgated during the early years of the 19th century was that a multicellular body is a colony of separate units by the vital activity of which the whole body is maintained. Many of the Fungi are composed of single cells, others are composed of a large number of cells variously united together to form the fungus body. A cell is usually surrounded by a distinct cell membrane or wall, and may be either uninuclear or multinuclear. In most fungal cells more than one nucleus is present. It is only in comparatively recent times that it has been found possible to determine with any degree of certainty that the minute deeply-stainable bodies observed in the cells of the Fungi can be regarded as nuclei. Twenty-five years ago the presence of true nuclei in the Fungi was still more or less problematical. Now we know that the nuclei in all forms above the Yeast Fungi and Bacteria are essentially the same in structure as in the higher plants. They possess a nuclear membrane, chromatin reticulum and nucleolus. In some Fungi structural modifications have been observed at certain stages which may possibly give us a clue to the origin and evolution of the nucleus.

The divisions of the nucleus in the basidium and ascus and in various other cells where it has been clearly seen resembles that which takes place in the higher plants. The nuclear membrane breaks down, chromosomes are formed which become arranged upon an achromatic spindle and the nucleolus disappears or is thrown out into the cytoplasm. The chromosomes become divided into two daughter groups which pass to the poles of the spindle and there become united again to form daughter nuclei.

The Fungi, as is well known, are distinguished from other plants by the absence of chlorophyll. They cannot obtain their food by the assimilation of inorganic compounds as green plants can, but are dependent upon organic food material, either dead or living, prepared by plants or by animals.

In considering the phylogeny of the Fungi, we are necessarily bound to consider their possible origin from chlorophyll containing organisms. But a consideration of the very lowest forms of life renders it quite impossible to say that the colourless forms

have of necessity arisen from the coloured ones. There is really no satisfactory evidence to prove either one or the other. From the fact that green plants are able by the action of their chlorophyll to make use of inorganic constituents it has been argued that green plants must have been forerunners of the colourless organisms. The protoplasm of a green plant is not, however, nourished by inorganic substances. The living protoplasm in any organism depends upon a supply of organic food material. In green plants this food material is prepared by the special apparatus of chlorophyll corpuscles which are able by the aid of the light rays absorbed by them to transform carbon dioxide and water into the organic food material, starch. Further, chlorophyll itself is an organic substance and must be therefore either a derivative of the protoplasm and secondary in origin to it, or its origin must be at least as difficult to account for as the origin of the protoplasm. It is possible that chlorophyll may be a product of the activity of protoplasm which appeared at a very early stage in the development of living organisms.

From the resemblance of certain forms of the Fungi to those of certain Algae it has been suggested that the Fungi may have arisen from algal like ancestors. This view is very largely accepted, but it is also possible to conceive the Fungi as having arisen from forms which are probably very closely related to the Chytridineae and the Myxomycetes, in the borderland between animals and plants.

All the various forms which we find among the Fungi are due to the growth, division and differentiation of cells. Unlike the higher plants the fungus cells frequently form filaments; and it is by the matting together of these and their association with one another that we get the fungus form. The production of special tissues and the division of labour among the cells is not however carried very far among the Fungi and never results in such pronounced specialization as is found in the higher plants.

In the lower forms, the Fungus consists entirely of a single cell, as in the Chytridineae, or of a more or less regular ramifying system of hyphae, growing over or penetrating the substratum, from which may arise hyphae bearing spores or conidia as in the common moulds or in the Peronosporeae. In these lower forms there is no definite fungus body and very little differentiation of tissues beyond the development of haustoria in parasitic fungi, and the formation of special hyphae for asexual and sexual reproduction. In the higher forms there is a distinct differentiation of the hyphae into vegetative and reproductive parts which is well marked in the gill bearing fungi and related forms. The reproductive portion or hymenium consists of a layer of cells, of which the fundamental elements are reproductive or spore

bearing cells—basidia, asci or conidiophores. The hymenium is as Vuillemin clearly points out a later differentiation than the sporophores themselves, and constitutes an anatomical differentiation realized independently of the histological perfection of the reproductive organs. The regular grouping of the reproductive organs into a hymenium presents therefore a morphological superiority to those forms in which the reproductive organs are carried on a diffuse mycelium. The physiological significance of this is probably bound up with the protection and dissemination of the spores and is, further, a device to obtain as much surface as possible for their development, very much as, in a confined space, a library grows by shelves radiating from its periphery into the central space. A transverse section of a young Agaric shows very clearly how space is economized in the arrangement of the gills so as to give the largest possible surface for the hymenium and the development of spores.

Among the fundamental elements of the hymenium (basidia and asci) we may have other elements such as paraphyses and cystidia which are not reproductive. It has been stated that these arise from a different layer of cells from those which give rise to the basidia. This is apparently the case with some cystidia which have been shown to be the terminations of the conducting or laticiferous hyphae, but it is not the case with all. The cystidia in some forms arise directly from the hymenial layer and appear to be modified basidia. Numerous suggestions have been put forward to account for the function of cystidia. Worthington Smith stated that they are male organs, containing spermatozoa, which fertilize the spores. Brefeld made the suggestion that the cystidia of *Coprinus stercorarius* may possibly act as props to keep the gills, when stretching, from pressing against one another. Professor Buller, who has recently investigated the function and fate of the cystidia in this species, also comes to the same conclusion. He points out that the cystidia serve as props, firstly, to keep the gills from touching one another during spore development; and, secondly, to provide sufficient interlamellar space for the free escape of the spores from between the gills during their discharge. My own observations entirely confirm those of Professor Buller as to the prop function. The apex of a cystidium grows outwards from a gill to come in contact with the gill adjacent to it and, forcing its way between the cells of the hymenium, becomes firmly attached to it. This attachment is so secure that the contraction which takes place when portions of the gills are placed in alcohol is not sufficiently strong to separate them.

In addition to the cystidia which thus function as props there are in some species cystidia which have some other function. Massee considers, for example, that the most important function

of these organs is connected with transpiration. Thus in *Peniophora* the cystidia become encrusted externally with minute colourless masses of oxalate of lime. This, according to Massee, is carried out of the tissues with the water of transpiration which gradually evaporates, leaving the lime in the solid condition.

In some forms the cystidia arise as the hymenial terminations of the so called vascular hyphae, as in *Lactarius rufus;* in other forms they arise from the hymenial layer, as in *Stropharia stercoraria.* In both cases they contain large quantities of glycogen, which seems to be exuded at a certain stage through the apex. What the function of this exuded glycogen may be, is a mystery. Possibly it may be taken up as food by the surrounding basidia, which are at this stage actively growing and producing spores and thus may require more nutritive materials than can be easily obtained from the mycelium.

In *Stropharia stercoraria* and *Mycena galericulata*, and possibly in other species also, the cystidia appear to be developed from basidia in which the two nuclei do not fuse. In the process of the formation of the glycogen these two nuclei gradually degenerate and finally disappear.

The presence of glycogen appears to be very general in the Fungi. In all the species of the Agaricineae and Gasteromycetes which I have examined it is abundantly present in the hymenium, and in many species also the basidia, as they come to maturity, are found to contain it often in large quantities. Miss Peniston and I found that in Yeast glycogen is formed and disappears rapidly under varying conditions of the environment and could to some extent be taken as a measure of the activity of the cell. It is possibly the same in the Fungi; glycogen is a substance easily formed, and easily used up; it is therefore peculiarly valuable wherever rapid growth and cell division is taking place, as in the formation of spores.

Since all the activities of a multicellular organism are the result of the activities of its individual cells, it is obvious that the solution of many important biological problems must ultimately be sought in the cell; and the Fungi, by reason of the slight differentiation of their tissues, offer an unusually good field for the investigation of such problems.

The development and growth of the individual depends upon the growth of suitable enzymes capable of effecting such changes in the raw material of the food substances as may enable them to be built up into the various cell modifications by the differentiation of which the specific or determining characters of the fungus species are produced. These enzymes are probably a product of the nuclear activity and especially of the chromatin.

Now the activity of the chromatin and any increase in the amount of it present in any given cell must depend upon the stimulus of temperature, oxygen, moisture, food, etc., supplied by the environment. If then the potential characters of an organism reside in the nucleus (germ plasm) and if the development of the nucleus depends upon external stimuli, it is clear that a variation in the development of the various characters may be brought about by variation in the stimuli. Some characters may be developed to a less degree under certain conditions than under others, and it is possible to conceive that in the absence of appropriate stimuli some characters may not be developed at all.

The morphological differentiation of a fungus may therefore be regarded as the resultant of two sets of conditions, one internal, the other external. The growth and development of the organism are accompanied by certain chemical and physical changes in the protoplasm, but we are not yet able to determine what part the cytoplasm and nucleus respectively play in these changes. There is very considerable evidence to show that all the vital activities of the cell depend in large measure upon the nucleus, and that it is in the chromatin especially that those potentialities are contained which govern the growth and differentiation of the organism. We find, for example, that in a fungal cell or hypha, wherever growth is taking place, the protoplasm becomes massed together in the growing region, and Haberlandt has shown that the nucleus is usually found in that part of the cell where growth is most active or lasts longest. Thus the enucleated half of a protoplast soon dies, but the half which still contains the nucleus continues to live and grow. In *Saprolegnia* the lateral branches of the hyphae are found to develop in the immediate neighbourhood of a nucleus. In the formation of the thick wall of the egg of *Cystopus*, *Peronospora*, &c., the numerous peripheral nuclei outside it take a principal share. It is probable also that the production of food reserves such as glycogen and fat may be associated with the extrusion of chromatin substance from the nucleus into the cytoplasm as occurs in the zygote of *Polyphagus Euglenae* and in the young basidia of some Basidiomycetes.

The external conditions of form production, such as heat, oxygen, the presence of inorganic salts and organic nutriment, light, gravity, &c., cannot be regarded as in any way formative. They provide the necessary energy by which the formative processes are set going in the cell and the supply of new material out of which additions are made to the material already present in it, and they may to some extent guide or make possible the formative processes in certain directions whilst restricting it in others. The embryonic cells of the higher plants are all capable potentially of producing a complete organ or organism. In the more

specialized cells which are developed along certain definite lines this power gradually disappears as they become more and more fitted for their special work. In the Fungi the power to reproduce fruit bodies is retained by the mycelial cells and it is probably true that if placed under suitable conditions as regards nutriment and humidity all the cells of a Fungus will be found capable of reproducing the fruit body. In the normal course of development, however, this power is only found in the reproductive cells. In the others, although each may carry within it the potentialities of the organism as a whole, there is a certain amount of specialization and modification to fit them for definite functions in the plant economy and the reproductive function is not developed. In the single-celled individuals all the functions of the organism, growth, food absorption, digestion, and reproduction are performed within the confines of the single cell.

Among the fungi we have much variation in a given species. This chiefly affects the vegetative tissues and results in changes in the size, texture, and colour of the fruit body, and may possibly be regarded as of the nature of somatic variation. The reproductive tissues, the hymenium with its basidia and spores, the spore coloration and number do not appear to be so variable, and such variations as occur may possibly be of the nature of germinal variations. Many of the variations which, as I have suggested, may be somatic or fluctuating variations, are very largely used in the distinction of species, and it is possibly due to this that so much difficulty is found, especially by inexperienced observers, in the determination not only of the species but even of the genera. I note that such an experienced observer as Mr. Carleton Rea quoted, evidently with much feeling, the following significant remark in his presidential address to this Society in 1908:—"The Mycologist must collect his own specimens and know them under all conditions." Even when he does this it seems to me he has not evaded all the difficulties which may prevent him from arriving at a perfectly satisfactory conclusion acceptable to his fellow Mycologists. Without constant practice in the field it appears to me to be impossible to obtain anything like an expert knowledge of the systematic relationships of the Fungi.

The Fungi as a whole are remarkably well adapted to their environment. This is clearly seen in the constant association of numerous well known forms with their habitats and the certainty of finding such forms in definite localities. So also forms which were originally supposed to be distinct species and even genera are now known to be stages in the life history of other and quite different forms. This may be very confusing to systematists, but it is of great interest to physiologists as showing what an important influence may be exerted upon the form of the fungus

by the environment. To what extent we can trace a relationship of cause and effect between the environmental conditions and the structural responses of living organisms is in fact one of the fundamental problems of biology.

Let us consider the problem as it presents itself in the development of one of the Agaricineae. The germ cell or spore gives rise to a mycelium on which the sporophore is developed. This sporophore passes through a definite series of forms in a normal environment which are throughout characteristic of the species. The young sporophore arises on the mycelial strand, which ramifies over or in the substratum, as a minute more or less spherical mass of filaments matted together in which no differentiation can be observed, and which are apparently growing in all directions. The first indication of any change in this indeterminate growth of the filaments is shown by a tendency to grow in one direction more than another and the change of this spherical mass into an oval or elongate shape. We then observe the first signs of differentiation. The internal hyphae tend to become parallel to one another, and the peripheral hyphae become more or less felted together to form the rudimentary universal veil or protective layer. The hymenium becomes differentiated in the internal weft of hyphae as a ring of cells near the apex of the fruit body. These cells are at first only distinguished by their more copious protoplasmic contents, but they soon begin to show a tendency to grow downwards, whilst the hyphae immediately above them tend to grow in a radial direction, by which the young pileus is gradually developed. The tissue immediately below the hymenial layer ceases to grow and a separation takes place, by which the gill cavity is formed. Then the gills begin to differentiate and a furrow, on the outside of the fruit body, marking the separation of the pileus, becomes more pronounced. By the subsequent growth of these various parts and their further differentiation we obtain the adult fungus body. We thus see that the primordia of the various tissues of the fungus are present at a very early stage, and some of the older observers considered that they were present from the very beginning. Thus, as Atkinson points out, Fries believed "that in the very young fruit body the organs or parts, though rudimentary and invisible, were all present, their manifestation and expression was a matter of unfolding." Atkinson shows clearly that in *Agaricus campestris* the young homogeneous fruit body shows at first no differentiation (except the universal veil); but the appearance of the primordium of the hymenium at once delimits also the primordia of pileus, stipe, and marginal veil. It is probable that there is a certain amount of variation in this respect in the different species. Thus in *Hypholoma fasiculare* I find that the young cap of the pileus

is distinctly marked off by the texture of its outer layer some time before the appearance of the primordium of the hymenium. And again in *Pholiota squarrosa* the delimitation of the pileus from the stipe is indicated long before the hymenium is differentiated by the difference in the direction of the curling of the scales of the universal veil.

Now, in considering the problem of the genesis of this fungus form, we want to know what are the causes which modify the primary structure of the rudimentary carpophore? Why, for example, should certain of the cells become modified to form the hymenium? How is it that all the cells which originate from one and the same spore apparently by an equal division of its parts, nucleus and cytoplasm, do not remain similar to one another? Why are some long, some short, some in the form of tubes, others oval or sperical in shape, some in the form of basidia or cystidia, others in the form of spores? Is it, as Klebs puts it, an expression simply of the "inscrutable inner nature of the plant" or can we control or modify it by alterations in the environment? "We can only realize that which potentially exists in the internal structure of a species" (Klebs). We have therefore two possible explanations of variation in cell development, (1) that the germ plasm of the spore in which, we may assume, all the potentialities of the organism reside, becomes unequally or qualitatively divided, and that by successive divisions therefore each cell is found ultimately with only those characters required for its own special development, or (2) that all the cells contain the same germ plasm, but owing to the variation in the environment certain parts only of this germ plasm are stimulated to grow, the others remaining in abeyance. From the fact that any part of a fruit body is capable, when placed under suitable conditions, of reproducing the whole, it would appear that the second alternative is more likely to be the correct one.

We may therefore ask:—To what extent have gravity, light, temperature, moisture and variation in nutrition the power to control or modify the growth of the germ plasm? Gravity plays an important part in maintaining the pileus in a horizontal position, a position which, according to the recent researches of Buller, is necessary for the efficient distribution of the spores. The stipe is negatively geotropic, the gills are positively geotropic. Buller also states that the hymenial tubes grow towards the centre of the earth and that the stimulus of gravity is responsible for the growth of the pileus flesh parallel to the surface of the earth. The appearance of the primordium of the hymenium in a definite position at the apex of the young carpophore suggests also a possibility that it may be due to some extent to a gravitational stimulus; but the fact that the young

fruit bodies are to be found growing in all positions in space whilst the hymenium is always in the same position relatively to the apex of the carpophore, negatives this view. The primary development of the hymenium is in all probability therefore due to a nutritional stimulus.

In some species light appears to be of importance as a stimulus to the production of the pileus. Buller mentions that when a fruit body of either *Lentinus lepideus* or *Polyporus squamosus* is grown entirely in the dark, it develops into a horn-like process without the least trace of a pileus or hymenium. E. Munch also found that the hymenium of *Collybia velutipes* developed only under the stimulus of light, and Wakefield has shown that *Schizophyllum commune* does not develop normally unless there is an all round illumination.

Variation in nutrition evokes a very definite modification in the Fungus body, as Klebs many years ago proved was the case with *Saprolegnia mixta.* He showed that when grown in a very favourable nutritive solution, containing principally nitrogenous substances, only vegetative growth of the mycelium takes place. The formation of asexual spores takes place when the mycelium is transferred to a poorer nutrient solution, or to water, whilst sexual organs were only formed when the fungus was subjected to a slow decrease of its nutrition. Thus, starting with spores which possessed within themselves the power to develop mycelium, zoosporangia, oogonia and antheridia, Klebs was able at will to produce any one of them by alterations in the supply of food.

I found that a somewhat similar phenomenon as regards the formation of asexual spores and sexual reproduction takes place with *Polyphagus Euglenae.* So long as the fungus is supplied with plenty of nutriment in the shape of fresh Euglena cells, asexual zoospores only are formed. This may be continued for several generations. As soon as the supply of food fails, sexual reproduction takes place. Dr. Kauffmann has shown that *Saprolegnia hypogyna*, which has morphologically no true antheridia, can be made to develop them under proper nutrient conditions, and Mr. Lechmere has recently shown that a species of *Saprolegnia* kept in pure culture in various media exhibited a variety of methods of asexual reproduction when grown under different conditions. Methods of asexual reproduction were observed in this one species which were regarded by earlier authors as characterizing six different genera of the family.

The influence of temperature has been recently studied by Mr. Bancroft in the case of *Cladosporium herbarum*, the life cycle of which is composed of two conidial forms, *Hormodendrum* and *Cladosporium*. *Hormodendrum* is parasitic and is a summer form found on green leaves of several species of plants. When

the leaves die, it passes to the *Cladosporium* form which is saprophytic on dead leaves. *Cladosporium* can give rise to *Hormodendrum* if the temperature be moderately high, but at a lower temperature it reproduces itself.

Experimental observations upon the more highly differentiated forms are much needed. Changes due to variation in nutrition are no doubt more easily brought about in those forms which are composed of cells that are only slightly differentiated than in those, such as the Agaricineae, which are more highly developed. But it is not at all unlikely that many of the variations observed in the larger Fungi may be connected with nutrition. Thus, Wakefield has found in *Schizophyllum commune* and *Stereum purpureum* that the tendency to fruit formation may be retarded by changing or weakening the culture medium. Moisture induces over development of mycelium, and no fruit bodies are formed, nor are they formed in too dry conditions.

It is quite clear therefore that the environment is capable of modifying the form and development of a fungus in a very definite and precise way, even to the extent of a modification in the development of the reproductive organs. But none of these observations proves that we have here any change in the germ plasm or that the environment is capable of producing permanent alterations of form which are inheritable under normal conditions. This is a problem which still remains unsolved, but upon which light may possibly be thrown by further researches in the domain of the Fungi.

Reproduction among the Fungi takes place by means of sexual or asexual spores or by vegetative propagation. There is no time now for me to do more than refer very briefly to the many interesting biological problems which are opened up by a study of the sexuality of the Fungi.

During the last twenty-five years the cytological features of sexual reproduction in this group have been carefully investigated and the phenomena as observed in species of *Peronospora* and *Albugo (Cystopus)*, in which there is a pronounced sexual differentiation into well marked male and female cells, have been brought into line with those in the higher plants and animals, so that we can now say, the act of fertilization in these forms consists in the definite fusion of a male with a female cell and the subsequent fusion of male and female nuclei.

In the higher groups of the Fungi, Ascomycetes and Basidiomycetes, the phenomena of sexual fusion are very different from those which obtain in the Phycomycetes, and present problems of great interest in connection with heredity and variation and the function or significance of sex. In some Ascomycetes there is a double nuclear fusion consisting, in the first instance, of the fusion of male and female nuclei derived from well marked

sexual cells, and secondly, at a much later stage in the development of the fungus, a fusion of two nuclei in the ascus. What may be the meaning of this second nuclear fusion we do not know, but it is very significant that it should take place at the termination of a long period of vegetative growth, during which time the fungus has been preparing for the production of vast numbers of spores by means of its asci. It has been suggested that the nuclei derived from the sexual organs do not actually fuse, that they only come into close contact with each other, and that the actual fusion is delayed until the ascus is formed. We know that in some of the lower forms of the Fungi nuclear fusion does not appear to be necessary either for the development and maturation of the zygote or for its germination. Thus it is known that in some cases the germ nuclei do not fuse until the zygote has become fully developed, whilst in *Polyphagus Euglenae* the fusion is actually delayed until after the entrance of the nuclei into the sporangium formed by the germination of the zygote. In this case therefore the nuclear fusion in the zygote is definitely replaced by a later nuclear fusion which takes place just before the spores are formed. How far this is comparable with what takes place in the Ascomycetes or the Uredineae remains to be seen.

That the ascus fusion is the only nuclear fusion that takes place in the Ascomycetes cannot, however, I think, be maintained in view of the very clear and detailed accounts given by Harper and others of the fusion of sexual nuclei in some well known forms. On the other hand there seems to be no reasonable doubt that the sexual organs are not formed in all cases and that the sexual fusion may be entirely replaced by the ascus fusion. Evidence is not wanting to show that there is a tendency in this group to degeneration of the sexual organs; in some forms they are functional; in others they are present but are not functional; and in some forms they appear to be absent altogether.

In the higher Basidiomycetes this degeneration of the sexual organs seems to have been more completely accomplished. No sexual organs comparable to those which are found in the Ascomycetes have yet been discovered, although diligent search has been made for them. The only nuclear fusion known is the fusion of two nuclei in the basidium, which are derived from the binucleate cells of the hymenium. In the Uredineae, however, we have some indication of how this may have been brought about. Blackman has shown that in some species at a certain stage certain cells become binucleate by the migration into them of a nucleus from an adjoining cell. This partakes of the characteristics of a reduced sexual cell fusion and the binucleate cell takes the place of and may be regarded as a

zygote. The nuclei do not fuse however; the cell divides and a long series of divisions ensues from the aecidiospore stage onwards, in which the binucleate condition of the cells is maintained, terminating in the formation of the teleutospores, in the cells of which the paired nuclei fuse. In the higher Basidiomycetes the cell fusion seems to have disappeared. The binucleate condition of the hymenial cells seems, however, to correspond to the binucleate cells of the Uredineae, and the fusion in the basidium appears to be comparable to that which takes place in the teleutospore.

One very interesting feature of this reduced sexuality in the Fungi is that the well defined sexuality, either heterogamous or isogamous, which exists in the lower groups has apparently been gradually replaced by a reduced or apogamous fertilization. In other words, the phylogenetic development of the Fungi has been accompanied by a gradual loss of sexuality in favour of an autonomous fusion of nuclei more or less remote in origin, and possibly in some cases even of sister nuclei. What advantage or disadvantage this may be we cannot know until we have more satisfactory knowledge of the function of sex and of cross-fertilization. No one could say, however, in view of the vast number of forms of the Basidiomycetes that their vigour has been impaired or that the power to vary has been lost. There is no evidence, however, that the loss of sexuality is accompanied by any pronounced tendency to mutation, but on the other hand it is obvious that the extraordinary amount of variation cannot be due to the blending of two lines of descent, unless we admit the possibility that there may be blending by the germination of masses of spores from different varieties to form a single fruit-body with a plasmogamous fusion among the filaments. Mutation may be common among the Fungi, but probably very largely owing to the difficulty of keeping them under observation, under definite conditions, for sufficiently long periods, we have no data for comparison. It is, however, a significant fact, as Atkinson points out, that a form of the edible mushroom cultivated for the market should show constantly two spores instead of four. The study of variations among the Fungi is, however, in its infancy. It opens up an extremely interesting field of investigation, the results of which, taken in conjunction with increased knowledge of life histories and the complex phenomena of the reproductive processes, may throw light upon many obscure problems of heredity and descent and the meaning of sex. We know practically nothing of the conditions under which variations are possible, or of the extent to which they may take place in any given form. We have no precise knowledge of the modifications due to the environment, to variation in the food supply, or as to the effects of light and heat

upon any of the higher Basidiomycetes. Neither have we any definite observations continued for a sufficiently long time upon the periodicity of the various forms nor their seasonal development and succession in a given area. All these problems and many others are well suited for investigation by such societies as this, and may be especially commended to those who possess, as do so many of our members, a large acquaintance with species and varieties in the field.

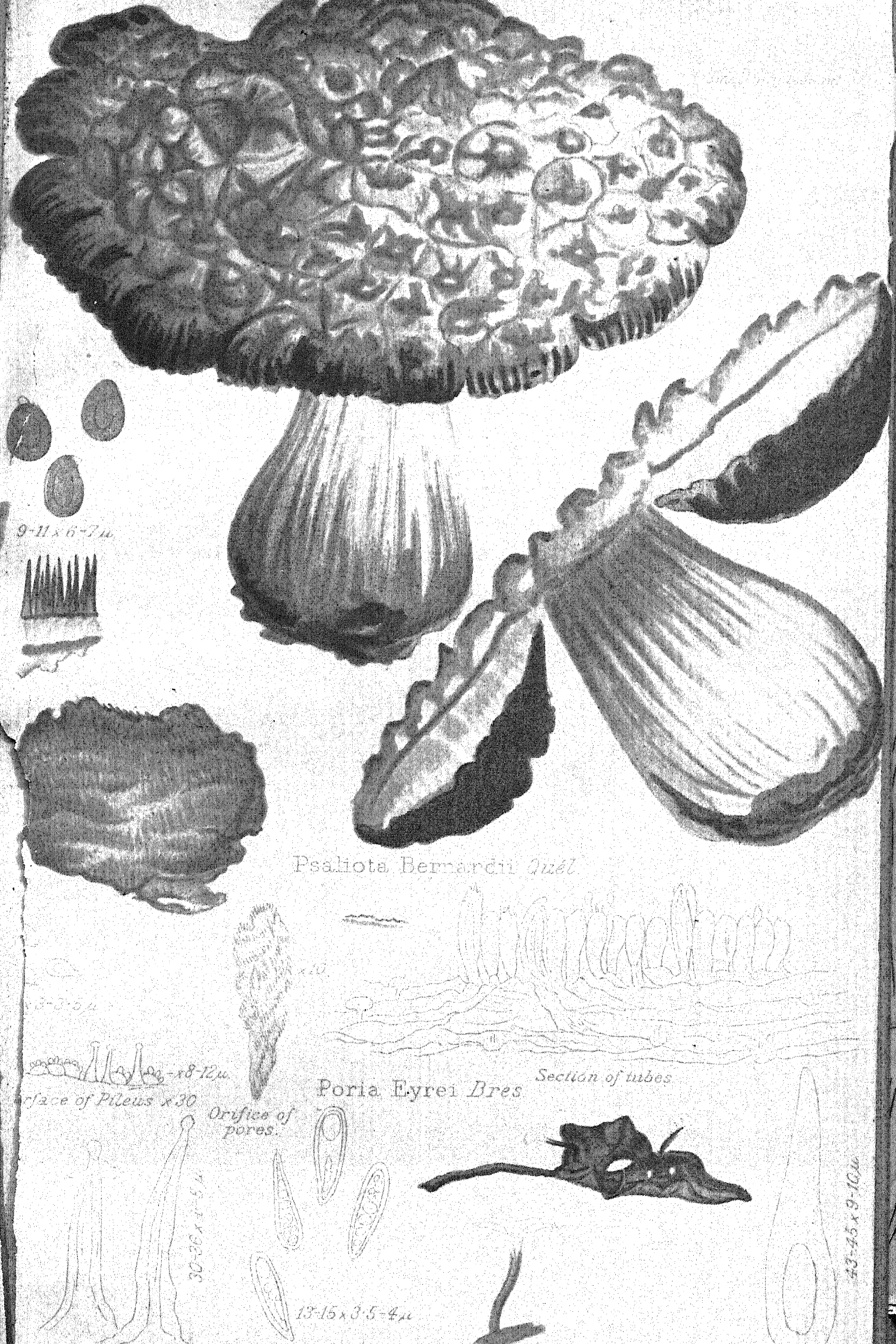
PORIA EYREI.

Par L'Abbé G. Bresadola.

Plate 14.

Effusa, flavida, margine subtomentoso, mox similari; subiculo tenuissimo, vix vissibili; tubulis brevibus, 1 mm. circiter longis, (obliquis in specimine viso, sed certe e loco); poris variabilibus, oblongis vel sinuatis, $\frac{1}{4}$-1 mm., ore integro; sporis hyalinis, obovatis, 1-guttulatis 4-5 × 3-3·5μ; basidiis clavatis, 12-15 × 4μ; cystidiis clavatis vel fusoideo-ventricosis, 15-18 × 4-5μ; contextu tubulorum ex hyphis septatis, ad septa saepe unilateraliter nodosis, 2-3μ crassis.

Hab. ad ligna Quercus, in sylvis frondosis. Thorny Down prope, Candover, Hants. Legit W. L. W. Eyre, 28-v-1910. Obs. Species haec habitu et contextu tubulorum omnino *Poriae vaporariae* Fr. similis, at colore flavido, forma sporarum obovata et presentia cystidiorum bene distincta.



Psaliota Bernardii Quél.

Poria Eyrei Bres.

Androsaceus epiphylloides Rea.

C. A. Rea del.

West, Newman chr.

BRITISH CLAVARIAE. A CORRECTION.

By A. D. Cotton, F.L.S.

In the last number of the Transactions a drawing of a Clavaria was given under the name of *C. persimilis.* (*Vide* Plate 11, fig. D., fungus, spores and basidia.) The drawing, which was kindly made by Mrs. Carleton Rea during the Baslow Foray, was inserted on the plate owing to a misunderstanding. It represents the new species *C. straminea* described below and not *C. persimilis*, the species dealt with last year.

The description of *C. straminea* is as follows:—

C. straminea Cotton sp. nov.

* Plants small, unbranched, isolated or caespitose, *straw-coloured, becoming brownish with age.* Smell and taste not marked. Clubs slender, brittle, 3-5 cm. high, 3-4 mm. thick, cylindrical or somewhat compressed, smooth, *apex usually acute.* Stem *usually very distinct cinnamon-yellow.* Flesh somewhat darker than hymenium. Internal structure pseudo-parenchymatous in transverse section. Basidia rather large, $40\text{-}60 \times 7\text{-}9\mu$, contents granular, sterigmata 4. Spores hyaline, smooth, granular; *globose* $5\text{-}7\mu$ diam., with a minute basal apiculus.

Hab. In short grass. Rare. Specimens examined from: Erringdon, near Halifax (C. Crossland, 1905); Carlisle (Miss D. Graham, 1908 and 1909); Chatsworth (A.D.C., 1909); Broseley, Salop (G. Potts, 1909); Clare Island (H. C. Hawley and A. D. C., 1910).

C. straminea resembles in colour *C. argillacea.* It differs in its smaller size, and in the clubs being cylindrical and pointed instead of flattened and blunt; it is moreover sharply distinguished from that species by possessing globose instead of elliptical spores. In both species the spore-bearing surface is paler in colour than the stem, and is more or less clearly separated from it. In *C. argillacea* the stem is yellow or greenish yellow, whereas in *C. straminea* it becomes a brownish red or cinnamon, and this colour is liable, especially if handled, to spread over the whole surface of the club. Several of the Baslow specimens

* Plantae simplices, pusillae, sparsae v. fasciculatae, stramineo-pallidae, aetate fuscescentes. Clavuli graciles, 3-5 cm. alt., 2-4 mm. cras., cylindracei v. complanati, leves, stipite luteo-cinnamomio. Basidia clavata, $40\text{-}60 \times 7\text{-}9\mu$, sporis hyalinis, levibus, globosis, $5\text{-}7\mu$ diam. Hab. Ad. terram graminosam.

turned dark with age, and in the specimen to the right on Plate 11 this is particularly noticeable. Young undamaged specimens are always pale.

C. straminea was first received from Mr. Crossland in 1905 from Yorkshire, and secondly from Miss Decima Graham, who sent Carlisle specimens. The gatherings agreed in spore-characters but differed in colour, and the plant remained a puzzle until the Baslow Foray. On this occasion a number of specimens were found in Chatsworth Park, and the difficulty as to colour was removed.

Fries in his Systema Mycologicum, vol. I., includes a plant—*C. flavipes* Pers.—which might possibly refer to this species. No specimen exists in his herbarium. As its identity is open to question and the figures quoted give no clue, it has not been thought advisable to adopt the name.

The above account of *C. straminea* concludes the descriptions of all the yellow unbranched Clavarias known in this country.

Opportunity is taken here to ask for specimens of, or information as to, *C. fistulosa* and *C. contorta*. In the Transactions for 1906 it was stated that von Höhnel regarded *C. contorta* as a morbid form of *C. fistulosa*. In 1907 Lind criticised von Höhnel's views, stating that he knew both plants and that they were good and distinct species. Lind agrees with the descriptions given in our text books (e.g., Massee and Worthington Smith) and further remarks, that in Denmark, *C. fistulosa* is found on Beech, and *C. contorta* on Alder, and that the spores of the former are much smaller than those of the latter. He finds no intermediate forms.

From the small amount of British evidence available, it appears probable that Lind is correct; but further confirmation is required. Both fungi occur late in the season, and it is suggested that Beech, Alder and Beech twigs be examined specially in the months of November and December.

A CONTRIBUTION TO THE MYCOLOGIC FLORA AND THE MYCETOZOA OF THE ROCKY MOUNTAINS.

By W. N. Cheesman, F.L.S.

The appended lists of Fungi and Mycetozoa were collected in the Rocky Mountains and Western Canada in the autumn of 1909, during a holiday after the meeting of the British Association at Winnipeg. Although ideal conditions for the growth of Fungi did not exist in the centre of the Dominion, yet from the foot-hills of the Rockies at Calgary to the Pacific coast, the moist warm atmosphere, always prevailing, was favourable to the growth of these organisms quite up to expectation. The hurried journey precluded the collection or observation of but few of the fleshy Agarics, and attention was mainly directed to those species which would suffer the least and allow of future examination. These were found to be the wood-loving fungi, for out of the eighty-seven species collected quite nine-tenths were growing on wood, and about one-third of the total number consisted of polypores.

As a varied geological country produces a varied phanerogamic flora, so a varied arboreal country produces a varied fungal flora; and it was a little disappointing to notice that many of the deciduous trees flourishing in Ontario and on the Atlantic sea board were unable to endure the rigorous winters of Winnipeg, and this diminution was more pronounced when the prairie, an immense treeless plain, was crossed. So it may be expected then that Western Canada, with its diminished number of species of forest trees, will not be so rich mycologically as the Eastern Provinces with their more varied arboreal flora. The Rocky Mountains were clothed with coniferous forests, fringed with species of Betula, Populus, Alnus and Salix, and the grassy places were gay with Artemisia-like Compositæ. A panorama of one hundred miles of magnificent scenery is seen from Banff to Revelstoke, from whence to the Pacific snow-capped peaks with wooded sides and fertile valleys dominate the landscape. It will be seen that some species like *Schizophyllum commune*, *Polystictus hirsutus*, *P. versicolor*, *Hymenochæte rubiginosa*, &c., are cosmopolitan and found in every quarter of the globe. Others like *Trogia crispa*, *Polyporus chioneus*, *Fomes connatus*,

Caldesiella ferruginosa, and many others, are found only in the Northern Hemisphere, whilst others like *Polyporus distortus, P. radicatus, Fomes leucophaeus, F. conchifer, Daedalea pallido-fulva*, &c., have so far only been found in North America. Further investigations will undoubtedly reveal an extended range of distribution in the various species of fungi.

The present list adds several new records to the Mycology of the New World. I have to express my thanks to our member Mr. G. C. Lloyd, of Cincinnati, for the examination and determination of most of the polypores, and to Miss Annie Lorraine Smith, F.L.S., for the information respecting distribution.

The abbreviations for distribution are:—*Eu.* = Europe; *As.* = Asia; *Af.* = Africa; *Am.* = N. America; *Aust.* = Australasia.

AGARICACEÆ.

Armillaria mucida (Schr.) Fr. *(Eu., As., Am., Aust.)*. On beech tree. Stanley Park, Vancouver.

Clitocybe sp. Nelson, B.C.

Mycena alcalina Fr. *(Eu., Am.)*. On decaying wood. Revelstoke.

Mycena tenerrima Berk. *(Eu., As., Am.)*. On fir cones. Lake Minnewanka, Banff.

Crepidotus mollis (Schaeff.) Fr. *(Eu., Am., Aust.)*. On growing wood. Medicine Hat.

Hypholoma fasciculare (Huds.) Fr. *(Eu., As., Af., Am., Aust.)*. On stumps, base of post, &c. Frequent.

Anellaria separata (Linn.) Karst. *(Eu., Am.)* In rank places. Revelstoke.

Coprinus comatus (Fl. D.) Fr. *(Eu., N. Am.)*. Near dwellings. Winnipeg, Glacier, &c.

Coprinus atramentarius (Bull.) Fr. *(Eu., N. Am.)*. Near dwellings. Sicamous Junction.

Coprinus ephemerus (Bull.) Fr. *(Eu., Af., Am., Aust.)*. Near dwellings. Kicking Horse Pass.

Bolbitius titubans (Bull.) Fr. *(Eu., Aust.)*. Among grass in wet place. Banff.

Cantharellus cibarius Fr. *(Eu., Am., Aust.)*. On roadside bank. Stanley Park, Vancouver.

Cantharellus aurantiacus (Wulf.) Fr. *(Eu., Am., Aust.)*. Round pine stump. Nelson.

Marasmius graminum (Lib.) B. & Br. *(Eu., Am.)*. On stems, grass, &c. Frequent.

Lentinus fasciatus Berk. *(Aust.)*. On felled logs. Winnipeg, Banff.

Panus torulosus (Pers.) Fr. *(Eu., Am., Aust.)*. On willow stump. Revelstoke.

Trogia crispa (Pers.) Fr. *(Eu., Am.)*. On birch, poplar, willow, &c. Frequent.

Schizophyllum commune Fr. *(Universal)*. On dead wood. Niagara, Chicago, Winnipeg, &c.

Lenzites betulina (Linn.) Fr. *(Eu., As., Am., Aust.)*. On birch. Winnipeg, Rocky Mountains.

Lenzites sæpiaria (Wulf.) Fr. *(Eu., Siberia, Am.)*. On birch. Winnipeg, Rocky Mountains, &c.

POLYPORACEÆ.

Polyporus adustus (Willd.) Fr. *(Eu., As., Am., Aust.)*. Often on charred wood. Frequent.

Polyporous Schweinitzii Fr. *(Eu., Himalayas, Am.)*. On pine stumps. Sicamous Junction.

Polyporus distortus Schw. *(Carolina)*. On pine stumps. Stanley Park, Vancouver.

Polyporus chioneus Fr. *(Eu., Siberia)*. On birch. Kamloops.

Polyporus cæsius Fr. *(Eu., Carolina)*. On pine trunks. Beacon Hill Park, Victoria.

Polyporus radicatus Schw. *(Pensylvania)*. On pine trunks. Revelstoke.

Polyporus dichrous Fr. *(Eu., Aust.)*. On pine trunks. Minnewanka Lake, Banff.

Polyporus albiceps Peck. On pine trunks. Crows Nest Pass.

Fomes pinicola Swz. *(Eu., Siberia, Am., Cuba)*. On pine trunks. Banff, Revelstoke, &c.

Fomes salicinus (Gmel.) Fr. (resupinate form) *(Eu., Am., Aust.)*. On poplar. Bow River Falls, Banff.

Fomes connatus Fr. *(Eu., N. Am.)*. On poplar. Frequent.

Fomes carneus Nees. *(Eu., As., Am., Aust.)*. On pine logs. Nakusp, Arrow Lakes.

Fomes igniarius (Linn.) Fr. (typical *(Eu., As., Am., Aust.)*. On poplar trunks. Stanley Park, Vancouver.

Fomes igniarius (Linn.) Fr. (resupinate form). On fallen poplar trunks. Stanley Park, Vancouver.

Fomes fomentarius (Linn.) Fr. *(Eu., Siberia, Am., Malay)*. On stump. Revelstoke.

Fomes leucophaeus Mont. *(Ohio)*. On worked pine wood. Moose Jaw.

Fomes applanatus (Pers.) Wallr. *(Eu., Am., Aust.)*. On poplar stump. Sicamous Junction.

Polystictus radiatus (Sow.) Fr. *(Eu., Am., Aust.)*. On alder, birch &c. Banff, Vancouver, &c.

Polystictus hirsutus (Schrad.) Fr. *(Universal)*. On alder, birch, &c. Niagara Falls to Vancouver.

Polystictus zonatus (Nees) Fr. *(Eu., As., Am.)*. On alder, birch, &c. Elm Park, Winnipeg, Banff.

Polystictus versicolor (Linn.) Fr. *(Universal)*. On deciduous trees. Banff, Laggan, &c.

Polystictus conchifer Schwtz. *(U.S.A.)*. Crows Nest Pass.

Polystictus abietinus (Dicks) Fr. *(Eu., N. Am.)*. On fir trees. Frequent.

Poria viticola Schw. *(U.S.A.)*. On fallen branches. Goat River Canon.

Poria vulgaris Fr. *(Eu., As., Af., Am., Aust.)*. On fallen branches. Frequent.

Poria pulchella Schwtz. *(N. Am.)*. On fallen branches. Stanley Park, Vancouver.

Trametes hispida Bagl. *(Italy, Algiers)*. On wood. Calgary.

Daedalea pallido-fulva Berk. *(U.S.A.)*. On dead branches. Medicine Hat.

HYDNACEÆ.

Caldesiella ferruginosa (Fr.) Sacc. *(Eu., U.S.A.)*. On fallen wood. Frequent.

Hydnum ochraceum (Gmel.) Fr. *(Eu., As., Am., Aust.)*. On larch branches. Nakusp, Arrow Lakes.

Tremellodon gelatinosum (Scop.) Fr. *(Eu., Am., Aust.)*. On rotting wood. Revelstoke.

Irpex cerasus Fr. (syn. I. paradoxus Schrad.). Nelson.

Radulum orbiculare Fr. *(Eu., U.S.A., S. Af.)*. On elm trunk. Winnipeg beach.

Phlebia vaga Fr. *(Eu., U.S.A.)*. On fallen branches. Mount Royal, Montreal, Banff.

Grandinia granulosa Fr. *(Eu., As., Am., Aust.)*. On decaying wood. Frequent.

Odontia fimbriata (Pers.) Fr. *(Eu., U.S.A.)*. On decaying wood. Kootnay Landing.

THELEPHORACEÆ.

Thelephora laciniata (Pers.) Fr. *(Eu., Carolina)*. On pine stumps. Revelstoke.

Stereum hirsutum (Willd.) Fr. *(Eu., Am., As., Aust.)*. On deciduous trees. Frequent.

Hymenochæte rubiginosa (Dicks.) Lév. *(Eu., As., S. Af., Am., Aust.)*. On birch, poplar, &c. Banff, Sicamous Junction.

Hymenochæte fuliginosa Lév. *(Eu., As., Am.)*. On birch, poplar, &c. Beacon Hill Park, Victoria.

Corticium calceum (Pers.) Fr. *(Eu., As., Am.)*. On fallen branches. Frequent .

Peniophora quercina (Pers.) Cooke *(Eu., U.S.A.)*. On fallen branches. Kicking Horse Pass.

Coniophora sulphurea (Fr.) Mass. On fallen branches. Kamloops.

Solenia anomala (Pers.) Fr. *(Eu., Siberia).* On fallen logs. Frequent.

CLAVARIACEÆ.

Clavaria crispula Fr. *(Eu., Am., Aust.).* Base of poplars. Banff.
Calocera viscosa (Pers.) Fr. *(Eu., U.S.A., Malacca).* On pine logs. Common.
Typhula erythropus (Pers.) Fr. *(Eu.).* On plant stems. Stanley Park, Vancouver.

TREMELLACEÆ.

Auricularia mesenterica (Dicks.) Fr. *(Eu., U.S.A., Aust.).* Simulating *Stereum hirsutum.* Niagara, Banff, &c.
Exidia glandulosa (Bull.) Fr. *(Eu., As., Af., Am., Aust.).* On dead branches. Revelstoke.
Tremella frondosa Fr. *(Eu., Am., Aust.).* On wet rotting twigs. Beacon Hill Park, Victoria.

LYCOPERDACEÆ.

Lycoperdon echinatum Pers. *(Eu., Am.).* On the ground. Sicamous Junction.

NIDULARIACEÆ.

Cyathus striatus (Huds.) Pers. *(Eu., Am., Af.).* On ashes. Nakusp, Arrow Lakes.
Sphærobolus stellatus (Tode) Pers. *(Eu., As., Af., Am., Aust.).* On moist wood. Medicine Hat, Stanley Park, Vancouver.
Sphærobolus minutissimus Schw. *(N. Am.).* On moist wood. Goat River Canon.

PYRENOMYCETES.

Hypomyces rosellus (A. & S.) Tul. *(Eu., N. Am.).* On *Polyporus chioneus.* Kamloops.
Xylaria anisopleuron Mont. *(Am., As.).* Stanley Park, Vancouver.
Daldinia concentrica (Bolt.) Ces. & de Not. *(Eu., As., Am., Aust.).* On poplar. Banff, Calgary.
Byssosphæria aquila (Fr.) On dead branches. Revelstoke, Glacier.
Psilosphæria spermoides Cke. On rotting wood. Maple Creek.
Melanomma pulvis-pyrius (Pers.) Fckl. *(Eu., N. Am.).* Elm Park, Winnipeg, Moose Jaw, West Robson.
Wallrothiella minima Fckl. *(Germany).* Crows Nest Pass.

DISCOMYCETES.

Leotia lubrica (Pers.) Fr. *(Eu., N. Am., Aust.).* In moist grass. Calgary.

Dasyscypha calycina (Schum.) Fckl. *(Europe).* On pine twigs. Revelstoke, Banff.

Erinella Nylanderi Rehm. *(Europe).* On dead stems. Medicine Hat, Kootenay.

Mollisia cinerea (Batsch) Karst. *(Eu., As., Af., Am., Aust.).* On rotting wood. Winnipeg, Vancouver, &c.

Orbilia rubella (Pers.) Karst. *(Europe).* On wet bark. Banff.

Coryne sarcoides (Jacq.) Tul. *(Eu., Am., Aust.).* On pine stumps. Revelstoke, Fort William.

MYCETOZOA.

The Mycetozoa are abundant in all temperate and moist tropical countries, but there seems to be an absence, so far as we can ascertain, of records of Canadian gatherings, except that made by A. and G. Lister in 1897, which Miss G. Lister kindly sent for comparison, and as this list has not been published hitherto it is with permission here given as a first instalment.

Localities. *Mus.* = Muskoka, *Tor.* = Toronto, *Mon.* = Montreal.

PHYSARUM GLOBULIFERUM Pers. *(Mus.)* P. BIVALVE Pers. *(Mus.).* P. CONTEXTUM Pers. *(Mus.).* P. VIRIDE Pers. *(Tor).* P. INAEQUALE Peck. *(Mus.).* FULIGO SEPTICA Gmel. *(Mon).* CRATERIUM PEDUNCULATUM Trent. *(Mus.).* C. LEUCOCEPHALUM Ditm. *(Mus.).* CHONDRIODERMA TESTACEUM Rost. *(Mus.).* [C. RADIATUM Rost. *Seattle.*] C. SPUMARIOIDES Rost. *(Mus.).* DIACHAEA ELEGANS Fr. *(Mus.).* DIDYMIUM EFFUSUM Link. *(Mus.).* D. NIGRIPES Fr. v. EXIMIUM Peck. *(Mus.).* D. FARINACEUM Schrad. *(Mus).* SPUMARIA ALBA DC. *(Mus.).* STEMONITIS FUSCA Roth. *(Mon. and Mus.).* S. FERRUGINEA Ehr. *(Mon. and Mus.).* LAMPRODERMA ARCYRIONEMA Rost. *(Mus.).* CRIBRARIA INTRICATA Schrad. near C. SPLENDENS Pers. *(Tor.).* C. INTRICATA v. DICTYDIOIDES List. *(Mon.).* DICTYDIUM UMBILICATUM Schrad. *(Mon.).* var. B. FUSCUM List. *(Tor.).* TUBULINA FRAGIFORMIS Pers. *(Mus.).* TRICHIA PERSIMILIS Karst. *(Mus.).* T. SCABRA Rost. *(Mus., Tor.).* T. FALLAX Pers. *(Mus.).* T. BOTRYTIS Pers. v. MUNDA List. *(Glacier).* HEMITRICHIA CLAVATA Rost. *(Mon., Tor.).* ARCYRIA ALBIDA Pers. *(Mon., Tor.).* A. PUNICEA Pers. *(Mon., Tor.).* A. FLAVA Pers. *(Mon., Tor.).*

Massee's "Myxogastres" (1892) has a few references to Canadian species. Lister's "Mycetozoa" (1894) further extended the localities and it is hoped that the new edition of the latter work (now in the press) will bring the information quite up-to-date.

Prof. Macbride's "North American Slime Moulds" contains no reference to any Canadian gatherings, but in all probability the species found in the United States of America will occur also in Canada.

Several species were found growing on charred wood (the effect of forest fires), but when we consider the marvellous life history of these organisms we can understand their adaptability to this strange "host-plant" Some were found to be abundant in Western Canada and rare here in Britain, whilst others common here were rare in Western Canada.

Our most common "Myxos," such as *Physarum nutans*, *Didymium difforme*, *Trichia varia*, *Lycogala miniatum* and *Arcyria punicea* were conspicuous by their rarity, their places being occupied by such species as *Chondrioderma globosum*, *Physarum contextum*, *Hemitrichia clavata* and *Lycogala flavofuscum*.

Epiphyllous species were fairly plentiful, especially on Poplar, Elm and other deciduous trees, but the wood and leaves of Conifers (of which the forests are mainly composed) did not appear to be favoured resting places for these organisms. Very few plasmodia were seen. Perhaps this would be due to the dry weather at the time of the visit, but several patches of sclerotia were gathered, and partly cultivated out at home, the cultures were by accident made too warm, and the plasmodia rising into sporangia were ruined with infusoria, probably *Paramœcia*.

Since returning, Prof. A. H. R. Buller has sent several species found in the neighbourhood of Winnipeg, including the rare *Lachnobolus occidentalis* (Macb.) hitherto only found in the United States of America. Professor Macbride records it from Maine, Iowa, Missouri and Nebraska, and Professor Farlow from New Hants. Prof. Buller also reports that a considerable number of species occur in the Winnipeg district, and await investigation.

I am particularly indebted to Miss Gulielma Lister, F.L.S., for her kindness in examining, verifying and determining the species, and for the notes dealing with their distribution recorded in the following list.

Ceratiomyxa mucida Schr. Revelstoke. Very widely distributed and common.

Badhamia utricularis Berk. Laggan. Widely distributed, but we have seen no specimens from the tropics, and have few specimens from the United States of America, though it does not appear to be rare there.

Badhamia panicea Rost. Banff. Medicine Hat. Fairly common in the British Isles and in Europe. We have seen no examples from the tropics. (A specimen from Dominica

we named at first *B. panicea* turned out to be *B. orbiculata* Rex.). Professor Macbride writes "this appears to be a purely western species," N.A.SL.M., p. 64. We have a number of gatherings from Colorado.

Physarum variabile Rex. Medicine Hat. Sicamous Junction. Macbride gives New York and Iowa as localities for this species. We have it also from Venezuela—the var. sessile, which is a very striking form and is perhaps worthy of specific rank. We have it from Philadelphia, S. Carolina, Antigua, Japan and Ceylon.

Physarum auriscalpium Cke. Revelstoke. Kicking Horse Pass. B.C. So far we have it from New England, S. Carolina, Colorado, from France, repeatedly from Germany, and from Portugal.

Physarum didermoides Rost. Winnipeg Beach. Nakusp. Arrow Lakes. Glacier. A widely distributed species, found in both temperate and tropical regions.

Physarum nutans Pers. Bow River Falls, Banff. Abundant and widely distributed.

var. leucophaeum Lister. Banff. Laggan. Rocky Mountains. Niagara. Apparently this subspecies is more frequent in temperate than tropical regions.

Physarum bivalve Pers. Laggan. Widely distributed in temperate and tropical regions.

Physarum contextum Pers. Kootenay Landing, B.C. Widely distributed in the north and south temperate regions; Professor Macbride records it from Nicaragua; this is the only record I know of from the tropics, but that is not very significant!

Fuligo septica Gmel. Lake Minnewanka, Banff. Common and widely distributed.

Craterium pedunculatum Trent. Hot Springs, Banff. Common and widely distributed.

Craterium leucocephalum Ditm. Revelstoke. Common and widely distributed.

Leocarpus vernicosus Link. Vancouver. Common in temperate regions; not recorded from the tropics, as far as I know.

Chondrioderma globosum Rost. Bow River Falls, Banff. Elm Park, Winnipeg. Common in North America, fairly abundant in Europe: apparently rare in the British Isles. I have no record of this from elsewhere.

Didymium difforme Duby. Stanley Park, Vancouver. Glacier, Rocky Mountains. Widely distributed but not common in the tropics.

Didymium clavus Rost. Banff. Widely distributed; but not common in the tropics.

Spumaria alba DC. Elm Park, Winnipeg. Beacon Hill, Victoria, B.C. Common in the British Isles, Europe and United States of America. Elsewhere we have it only from Bolivia.

Stemonitis fusca Roth. Nakusp, Arrow Lakes. Very common and widely distributed.

Stemonitis ferruginea Ehrenb. Banff. (Spores 6-7μ). Very common and widely distributed.

Comatricha typhoides Rost. Glacier, Rocky Mountains. Common and widely distributed.

Dictydium umbilicatum Schrad. Stanley Park, Vancouver. Common and widely distributed.

Tubulina fragiformis Pers. Emerald Lake, Field. Rocky Mountains. Common and widely distributed.

Enteridium Rozeanum Wing. Stanley Park, Vancouver. Except perhaps for the type gathered near Paris (about which there is a doubt) the only records of this are from North America. Macbride writes "very common, especially west."

Lycogala flavo-fuscum Rost. University Gardens, Toronto. Winnipeg. Revelstoke. Widely distributed, but apparently nowhere common.

Lycogala miniatum Pers. Crows Nest Pass, Rocky Mountains. Very common and widely distributed.

Trichia scabra Rost. Hot Springs, Banff. Common in the British Isles and Europe. Mr. Petch records several gatherings in Ceylon; "Not uncommon in North America," Macbride.

Trichia varia Pers. Moose Jaw. Bow River Falls, Banff. Common in the British Isles, Europe and North America. Mr. Petch finds it "fairly common" in Ceylon. We have it also from Teneriffe. It is probably widely distributed.

Trichia fallax Pers. Vancouver (Hotel Garden). Common and widely distributed.

Oligonema nitens Rost. Bow River Falls, Banff. Apparently distributed over North America and Europe, but not common. *O. flavidum* Peck (including *O. brevifilum* Peck) is more abundant there than *O. nitens*: we have received thirty specimens of the former and three of the latter, including your gathering, from Banff. We have no record of either species of *Oligonema* from elsewhere.

Hemitrichia rubiformis List. Glacier. Fairly common throughout Europe and the United States: it is also recorded from Madagascar, Ceylon, Java and the West Indies.

Hemitrichia clavata Rost. Banff. Sicamous Junction. Common and widely distributed.

Arcyria ferruginea Saut. Medicine Hat. Banff. Abundant in the British Isles and fairly so throughout Europe. We have it recorded from German East Africa, Ceylon (one gathering), New Zealand. Macbride writes "rare" for North America; we have seen several gatherings from New England, and have it also from the state of Washington.

Arcyria punicea Pers. Stanley Park, Vancouver. Very common and widely distributed.

Arcyria flava Pers. Glacier. Banff. Not uncommon and widely distributed.

Perichaena populina Fr. Kootenay Landing. Fairly abundant throughout Europe and the British Isles; we have it also from Ceylon, Singapore and Tasmania: "apparently not common" in United States of America," Macbride writes.

Perichaena variabilis Rost. Revelstoke. Widely distributed, but not common, perhaps overlooked.

RECENT WORK ON THE GENUS COPRINUS.

In his interesting and instructive volume entitled "Researches on Fungi,"* Professor Buller gives in Chapter XIX. a detailed account of the development and spore-liberation of *Coprinus comatus;* whilst more recently in a paper in the Annals of Botany (vol. XXIV., Oct. 1910, p. 613-628) he deals similarly with *C. atramentarius*. The mechanism of the fruit bodies of these fungi is so interesting and instructive, that a notice in the pages of the "Transactions" is more than justified. Buller's researches will moreover be of great value in the systematic study of the genus, a piece of work which we understand he has himself taken in hand.

The following summary will serve to indicate the nature of recent investigations; and if the new lines of study are applied to correctly named specimens of other species, much valuable work will be accomplished. The time-honoured methods of external characters, coloured drawings and the dried specimen cannot be ignored or set aside; and Professor Buller realizes that in studying the more critical species, the assistance and the experience of the field-mycologist is invaluable if not essential. On the other hand, the systematist will be anxious to acquire methods by which to obtain additional characters for his diagnoses, and will appreciate all the information that those skilled in microscopic technique can impart.

Taking first *C. comatus*, we find that in the early stage (whilst the pileus is still bell-shaped) there is a thickened margin at the edge of each gill which is devoid of basidia, but from which large coloured cystidia protrude. The latter are in contact with the cystidia of the adjacent gills. The inflated margin serves to prevent surface-contact of the gills and to allow space for the development of the basidia and spores; it breaks down immediately before the first spores on the gill are ripe. The so-called "deliquescence" is shown to be in reality a process of *autodigestion*. The solid parts of the gills become fluid, not through taking up water from the atmosphere, but by the breaking down of the cells and their contents, apparently through the agency of digestive enzymes.

The spores ripen in a regular way in a zone beginning at the lower end of the gill immediately within the thickened margin,

*Longmans, Green & Co., London, 1909, p. 274, plates 5, text figures 83
Price 12/6, net.

and proceeding obliquely upwards, the pileus at the same time expanding and the process of autodigestion following. The sequence of events is described thus by the writer:—"With the commencement of spore-discharge, or possibly just previous thereto, the marginal cystidia bordering on the zone of spore-discharge break down, and become fluid and unrecognizable. The discharge of spores leads to the production of a zone of spore-free gill-surface. Before this has become 0·5 mm. wide, it becomes subjected to the process of autodigestion. The basidia at the gill-edge which were the first to discharge their spores, together with the paraphyses between them, rapidly loose their sharp contours, become entirely disorganized and turn into fluid. The subhymenial cells and those of the trama break down in a similar manner. Thus the gill-edge for a distance of about 2 cm. becomes converted into a dark liquid film. We can now distinguish five zones on each surface of a gill, running parallel to its oblique edge. Highest of all is a zone bearing basidia with ripe spores. Below this is the narrow zone of spore-discharge, where the basidia are rapidly freeing themselves of their spores, by shooting them out one by one into the interlamellar spaces. Further below there is a narrow zone of spore-freed surface, where the basidia all have naked sterigmata. Below this again is the zone of autodigestion where the basidia and paraphyses are becoming disorganized and liquified. Finally, occupying the extreme gill edge there is a dark coloured adhesive, liquid film."

The process of autodigestion is very important in connection with the liberation of the spores. Through it, the spore-freed portions are removed, and the pileus is enabled to turn outwards and successfully liberate the spores from the upper parts of the gills. The inky drops produced by autodigestion consist of a brown fluid which contains granules; the black colour is not due to spores, though under certain conditions these bodies may become mixed with the fluid; spore-discharge and autodigestion being clearly distinct processes. In dry weather much of the fluid disappears by evaporation, the amount present increasing with the amount of atmospheric moisture. Buller maintains that the spores are dispersed by wind and that insects do not visit the plants. For further details the work itself must be consulted; but it may be added that in order to observe the processes described, the plants must be kept in their natural vertical position. If they are laid horizontally the gills become stuck together, the fluid collects, and the whole mechanism is destroyed.

Turning now to *C. atramentarius* we find several striking points of difference. In *C. comatus* surface-contact of the gills in the young state is prevented by a thickened gill-margin; in

C. atramentarius it is effected by the presence of stout cystidia over the whole hymenial surface. The apical end of each cystidium becomes fixed into the hymenium of the gill opposite to it, a fact which has led in the past to erroneous interpretations of these structures. Besides acting as props to prevent contact, the cystidia serve to ensure sufficient intralamellar space for the escape of the spores.

Spore-discharge takes place, as in *C. comatus*, in a progressing zone from the bottom of the gill upwards, the lower part of the gill (from which the spores have been shed) being gradually removed by the process of autodigestion. The presence of large and numerous cystidia in the zone of spore-discharge would form a serious hindrance to the escape of the spores by blocking up the interlamellar spaces. With beautiful accuracy the cystidia are however removed when their function as props is no longer required. It is found they do not undergo autodigestion at the same time as the basidia and paraphyses in their immediate vicinity, but they do so a short time previously. They are digested in succession from below upwards and each one disappears a few minutes before the basidia in its neighbourhood come to be involved in the upwardly progressing zone of spore-discharge. They thus remain as props till the last moment, but disappear in time to prevent their hindering the fall and escape of the spores. The whole process is a remarkable example of cellular specialization, and forms another instance of the exquisite perfection of structure and function with which even the lowliest plants are endowed.

It is pointed out that in the *Coprini* the gills are not only of extreme thinness, but that they are parallel sided, and not wedge-shaped as in the Mushroom; and it is suggested that autodigestion may be of special value in successful spore-liberation from parallel-sided gills.

A few notes on other species are given. In some cases interlamellar spaces are provided by a thickened gill-margin, in others by the presence of cystidia on the surface of the gill. Whilst it is not to be expected that all the species of *Coprinus* will be as thoroughly investigated as *C. comatus* and *C. atramentarius*, a careful examination of the gill-structure is required, and an improved classification is much needed. It is to be hoped that members of the B.M.S. will take up the study, and do all they can to assist in the preparation of a most useful revision of the genus.

A. D. Cotton.

NOTE ON THE STRUCTURE OF BRITISH GRANDINIAS.

By E. M. Wakefield.

In the course of the examination of some fresh material of *Grandinia mucida*, as understood by British authors, some interesting anatomical details were observed, which may possibly prove of value in differentiating the species of this very imperfectly known genus.

In vertical sections through the fungus, the tissue is seen to be studded with numerous large spherical vesicles, which in water appear strongly refractive, and of a yellowish colour. Staining with methylene blue reveals the fact that each vesicle is formed as the swollen end of a short hypha, and subsequently becomes cut off from the parent hypha by a wall which protrudes upwards into the cavity of the sphere, forming a small "columella." The strongly refractive appearance of the vesicles is due to their oily contents, which become slowly brownish and appear densely granular when treated with osmic acid. The young vesicles are completely filled with oil-containing protoplasm, and show a large central nucleus. In the older, larger vesicles, the protoplasmic contents appear restricted to the lower part of the cell, while the upper part at first contains some oily matter, but eventually becomes empty.

The vesicles form a more or less regular series parallel with the substratum, the largest occurring next the substratum, while the smallest are found in or near the hymenial layer. In addition to these vesicles, the tissue also contains a large number of crystal-clusters, some of which appear to be excreted at the tips of slender hyphae. The only other species which has been as yet examined in a fresh state is *Grandinia granulosa* Fr., in which such structures are completely lacking. Hence the presence or absence of vesicles affords a sure means of distinction between these two species. Comparison with dried material does not yield very satisfactory results. No type specimen of *G. mucida* Fr. is available, but evidence of identical structure has been found in a specimen so named by Berkeley, and, further, in a specimen determined as *G. crustosa, var. lignorum* by the same authority. The usual form of *G. crustosa* Fr. however, appears to be sufficiently distinguished from the present species by its somewhat thicker substance, in which the hyphae tend to form alternating layers of close and loosely-woven tissue. Spherical "fat-cells" were recorded for *G. crustosa* by Istvanffi.* but the examination of dried material has failed to confirm this observation.

*Istvanffi Pringsh. Jahrb. 29, 1896, p. 425.

NEW OR RARE MICROFUNGI.

By A. Lorrain Smith, F.L.S.

PHYCOMYCETES.

Plasmopara pusilla Schröt., in Krypt, Fl. Schles. III., p. 237.

Forming short, thick, white tufts. Conidiophores numerous, emerging in groups from the stomata, 60-130μ high, non-septate below, sparsely branched above, indistinctly forked, more rarely three-branched, the apices simple or divided, the terminal branchlets awl-shaped, stiff and straight; conidia variable in form and size, globose-ellipsoid, or ovoid, usually with a more or less distinct papilla, colourless, 24-40μ × 20-25μ, germinating with zoospores. Oospores globose with a thin yellow-brown membrane, up to 40μ in diameter. Germination unknown.

On Geranium. Collected by Mr. D. A. Boyd on *Geranium pratense* at Borthwick, Midlothian, October, 1910.

DISCOMYCETES.

Helotium rubescens Rehm. in Rabenhorst's Krypt. Fl. i. 3, p. 775 (1896).

Apothecia congregate, roundish at first, then cup shaped or flattened, margin at first entire, becoming flexuose, bent and crenate, disc scarlet-red; externally yellowish-red and somewhat rough, stalk short and thick, 1-5 mm. high, 2·5 mm. wide, Asci elongate, clavate, rounded above, about 100-110μ long; spores 8 in the ascus, elongate, slightly tapering at the ends, simple, colourless, 8μ × 3μ, 2-seriate above, 1-seriate below; paraphyses slender, scarcely thickened upwards, colourless.

A very yellow form of this fungus was collected by Mr. J. Menzies on Ash and Hazel stumps at Quarry Mill, Perth, March, 1910. One only of the apothecia had a reddish tinge.

Sphaerospora trechispora Sacc. var. *paludicola* Boud. Icones Mycologicae II., pl. 376, n. 225 of text.

J. A. Wheldon, in Lancashire Naturalist III. (1910), p. 83. Boudier states that:—" This variety does not appear to me to differ from the type except by its slightly larger spores 22-26μ, by its somewhat shorter external hairs and by its more moist habitat."

PYRENOMYCETES.

Gloniopsis decipiens de Not. Piren. Isterini in Giorn. Bot. Ital. ii. p. 12 (1847).

Apothecia congregate, carbonaceous, black, superficial, elongate-linear, often slightly bent, blunt at the ends, simple, not furrowed, with a narrow disc, about 1-2 mm. long, $\frac{1}{3}$ mm. wide; asci clavate, thick walled, 90-100μ long, 18-21μ thick, 8-spored; spores ellipsoid, colourless, up to 8-septate, with 2-3 longitudinal septa, 21-30$\mu \times$ 9-12μ; paraphyses branched above, forming a thick brown epithecium.

On Oak palings, Llanfaes, Brecon.

The specimen of this fungus preserved in the herbarium of the British Museum is very old, and was collected by Rev. Hugh Davies (1739-1821). He found it by the road-side on a gate made of the wood of some deciduous tree, presumably oak, and labelled it *Hysterium* sp.

Mycosphaerella citrullina Grossenb. N.Y. Agric. Expt. Stat. Techn. Bull. n. 9 (1909); Kew Bulletin, 1909, p. 293.

Perithecia depressed-globose, rough, dark-coloured, mouth papillate, becoming almost superficial, 100-165μ diam.; asci cylindrical-clavate, 8-spored; spores colourless, oblong, fusiform, 1-septate more or less constricted, the upper cell often largest.

Ascochyta sp.—Pycnidia depressed-globose, wall thin, parenchymatous, pale brown, mouth minute, distinct, 90-160μ diam., produced under the epidermis, then bursting through, spores colourless, cylindrical, becoming 1-septate and slightly constricted, 9-16$\mu \times$ 4-6μ. Pycnidial stage.

Both forms on Tomato plants, Waltham Cross, and on Cucumber plants, Gloucestershire.

SPHAEROPSIDEAE.

Dendrophoma podetiicola Keissl. in Oesterr. Bot. Zeitschr. LX. p. 57 (1910). *Lichenosticta podetiicola* Zopf, Unters, paras. Pilze d. Flecht. in Nova Acta Leop.-Carol Akad. Naturf. LXX., p. 263, figs. 22-25 (1898). *Microthelia alcicornaria* Lindsay in Trans. Roy. Soc. Edin. XXII., p. 161, t. 8, fig 3 (1859) (descript. sine nomine) and in Journ. Microsc. Sci. IX., p. 349 (1869) (nomen sine descript.).

Perithecia semi-immersed, black, or brownish-black, about 150μ in diameter; spores small, colourless, kidney-shaped, usually with two small guttulae, about 6-8$\mu \times$ 3μ; sporophores branched.

Parasitic on the podetia and squamules of *Cladoniae.*

Placed by Keissler in a recent paper in *Dendrophoma* on account of the branched sporophores. He has associated Lindsay's plants with the above species. I have been unable to verify this.

Diplodina lichenoides A. L. Sm.

Pycnidia crowded, hemispherical or subconical, superficial or the base slightly immersed, black, shining. Sporophores very short, simple, bearing the spores at the tips; spores oblong-ellipsoid, 2-celled, colourless, small, about $10\mu \times 3\mu$.

On the bark of *Walnut* trees, *parasitic on a Lichen thallus*. Collected at Waterhouse Farm, Writtle, Essex, in 1849, by H. Piggot, and preserved in his Lichen Herbarium.

Sirothecium Karst. in Meddel. Soc. Faun. and Fl. Fenn. XIV. p. 105 (1887).

Perithecia erumpent becoming superficial, almost globose or somewhat elongate, carbonaceous-cartilaginous, smooth, black, opening irregularly; spores in small chains, simple, brownish, fasciculate on one-celled sporophores.

A genus of Sphaeropsideae with few representatives. It is distinguished by the chains of brown spores.

Sirothecium lichenicolum Keissl. in Oesterr. Bot. Zeitschr. LX. p. 56 (1910). *Torula lichenicola* Lindsay Observ. new Lich. Micro-Fungi in Trans. Roy. Soc. Edinb. XXV. (1869) pp. 515 and 530 t. 24, figs. 1-18.

Perithecia globose, black, immersed then erumpent; spores greyish-green or olive-brown, oblong, usually with two small guttulae, about $6\text{-}8\mu \times 3\text{-}4\mu$.

Parasitic on the Apothecia of *Lecanora rugosa subsp. chlarona*. Lindsay gives other lichens as host-plants—*L. subfusca*, and *L. albella* (thallus as well as apothecia) and describes it as associated with *Lecanora candelaria*, *Enterographa crassa*, *Physcia pulverulenta*, &c., but Keissler considers that Lindsay is dealing with a composite species.

HYPHOMYCETES.

Ramularia Winteri Thüm in Hedwigia XX. (1881), p. 57.

Definite spots wanting, but brownish patches present on the leaves. Tufts developed on the under surface, slender, loose, white and powdery. Conidiophores emerging from the stomata, upright, septate, slightly widening upwards, about 30μ long, $2\text{-}3\mu$ thick; conidia ellipsoid-cylindrical, rounded at the ends, often somewhat clavate, straight or slightly bent, septate in the middle and slightly constricted, sometimes 4-celled, colourless, $17\text{-}33\mu \times 3\text{-}7{\cdot}5\mu$.

Recorded on several species of *Ononis* in Austria, Germany and Denmark. Collected by Mr. D. A. Boyd on *Ononis arvensis* at Saltcoats, Ayrshire, October, 1910.

Acremonium spicatum Bon. Hanb. Allgem. Myk., p. 91, fig. 104 (1851).

Hyphae creeping, sparingly septate. Conidia borne on short lateral branches arising singly from the hyphae or grouped near the apex of a filament, globose, often with a distinct outer wall, colourless, 10-12μ in diameter.

The whole fructification recalls that of a colourless *Sepedonium* but the conidia are smooth and smaller than those of that genus.

Found and determined by J. W. H. Johnson in cultures of sewage Fungi, Ilkley, York., April, 1910.

Botrytis argillacea Cooke in Grevillea III., p. 183, 1875.

A very fine specimen has been sent for identification both last year and this by Rev. W. L. W. Eyre. It was growing on a stump and formed a compact clay-coloured felt. The conidiophores are exceptionally well-developed, and at the tips they are rather swollen, irregular and jagged where the conidia are inserted. The conidia mostly ellipsoid vary to almost globose.

On stumps of a tree, Swarraton, Alresford, Hants, January, 1911.

NEW AND RARE BRITISH FUNGI.

By Carleton Rea, B.C.L., M.A., &c.

With Plates 14,* 15 and 16.

Psaliota Bernardii Quél. Soc. Bot. XXV. t. 3, f. 12. Fl. Myc. 73 and see plate 14.

Pileus 10-20 cm. wide, convex then expanded, firm, the tomentose surface of the pileus soon breaking up into *thick, angular warts*, white then turning ferruginous at the apex of the warts. Stem 6-7 cm. long, 4-5 cm. thick, bulbous at the base, attenuated upwards, *solid*, stuffed with delicate threads, striate at the apex, white becoming reddish brown with age. Ring membranaceous, soon disappearing, striate on the upper surface. Gills 8-12 mm. wide, free, attenuated at both ends, greyish flesh colour, finally blackish purple. Flesh firm, white then tinged with purple and finally stained with reddish brown. Smell *unpleasant*. Taste disagreeable. Spores blackish purple, ovoid elliptical, $9\text{-}11 \times 6\text{-}7\mu$, one guttulate with an apical germ pore.

Amongst short grass, fifty yards from the edge of the cliffs near the sea, Bettyhill, Sutherlandshire, Miss Alice Warrender, 1st October, 1910.

Our member Monsieur René Maire, D.Sc., kindly confirmed my determination of this plant and told me that he had found it in many places near to the sea, In France near the mouth of the Loire, In Algeria at La Lenia, near Oran, and on the border of the high lands of Chott and Chergui, In Greece at Argos and in Hungary on the Putza Hortebagy.

This very distinct Mushroom is easily recognized by the surface of the pileus breaking up into areolated warts and by its disagreeable smell.

Psaliota exserta Viv. Fr. Hym. Eur. 280 and see plate 15.

Pileus 6-18 cm. wide, fleshy, campanulate then convexo-expanded, white becoming yellowish ochraceous and broken up into minute adpressed scales. Stem 10-15 cm. long, 3-6 cm. thick, stuffed, either slightly attenuated upwards from the base or ventricose at the middle, white, *bleeding when cut or wounded*, almost smooth. Ring large, membranaceous, thick, *double*, made up of two layers that split apart, white, covered on the underside with yellowish, fugacious warts. Gills 5-10 mm. wide, free, somewhat crowded, whitish then pinkish and finally fuscous. Flesh *quickly turning bright red when bruised or*

* The Rev. W. L. W. Eyre, has most generously presented the Society with this plate.

cut or wounded and exuding a bright red juice which finally stains the part affected deep brown. Smell and taste pleasant. Edible. Spores subglobose, 5-6 × 4-5μ, one guttulate with an apical germ pore, deep ochre when deposited in the mass.

Solitary or in rings amongst rank grass, pastures near Inchbrook, Gloucestershire, Mr. Basil P. Marmont, 6th November, 1908.

This species is characterized by its double ring, deep ochre subglobose small spores and the bright blood-coloured juice which it exudes when cut or wounded.

Psaliota flavescens Roze. Quél. Fl. Myc., 73, pro parte., Gillet Ch. de Fr. 129 and see plate 16.

Pileus 5-12 cm. wide, campanulate then expanded, smooth, dry, *shining with a satin-like sheen*, white, at once *turning saffron colour* then *finally light brown when touched or bruised*, pellicle easily separable. Stem 10-14 cm. long, 1·5-2 cm. thick, cylindrical, *long* in proportion to the dimensions of the pileus, stuffed with a few loose threads when young, soon hollow, *white with a satiny sheen*, tinged reddish yellow at the base on one side. Ring membranaceous, soon disappearing, dirty white, yellow on the outside and more deeply coloured at the margin. Gills 5-12 mm. wide, free, crowded, pale pink then pink and finally brownish. Flesh white, turning instantly bright saffron yellow when fresh and reddish yellow when drier, especially near the surface of the pileus and at the base of the stem. Smell none. Taste not disagreeable. Spores oval, 5-6 × 4-5μ, reddish brown, one guttulate with an apical germ pore.

Solitary or in clusters and rings, in open upland pastures, near Inchbrook, Gloucestershire, Mr. Basil P. Marmont, 6th November 1908. Above Ribbesford, Worcestershire, October, 1909, C. R.

Easily known by its long white satiny stem and pileus, which instantly turn bright saffron yellow at the slightest touch or when bruised. This species is very poisonous to many people. Quélet seems to have included in his definition of *P. flavescens* some characters that are attributable solely to *P. xanthoderma* Genev. This latter species is characterized from the former by its offensive smell, shorter and broader stem, and pear-shaped reddish brown spores 6 × 4μ.

Androsaceus epiphylloides Rea. See plate 14.*

Pileus 2-5 mm. wide, membranaceous, somewhat spherical at first, then convex and expanded, *tomentose*, white. Stem 3-8

* Pileus 2-5 mm. latus, membranaceus, e convexo-subhemisphaerico expansus, *tomentosus*, albus. Stipes 3-8 mm. longus, ·5 mm. crassus, e farcto fistulosus, aequalis, velutinus, spadiceus apice albus. Lamellae albae, adnatae, ·5-1 mm. latae, interdum venoso-conjunctae, distantes, paucae. Sporae albae, hyalinae, *elongato-clavatae*, 13-15 × 3·5-4μ, multiguttulatae. Cystidia cuspidata, basi ventricosa, 43-45 × 9-10μ. Hab. ad folia exsiccata Hederae Helicis.

mm. long, ·5 mm. thick, stuffed then hollow, equal, velvety, chestnut brown, white at the apex. Gills white, adnate, ·5-1 mm. wide, sometimes connected by veins, distant, few. Spores white, hyaline, *club shaped*, 13-15 × 3·5-4μ, multiguttulate. Cystidia 43-45 × 9-10μ, attenuated at the apex, ventricose at the base.

On dead Ivy leaves, Swarraton, Hants, November and December, 1909 and 1910, Rev. W. L. W. Eyre.

The tomentum on the surface of the pileus consists of two forms of cystidia, the one 30-36 × 4-5μ, the other short, toothed at the apex on the margin and from 8-12μ wide. Easily distinguished from *Androsaceus epiphyllus* (Fr.) Pat. by the tomentose pileus and long club-shaped spores.

Fomes laccatus (Kalchbr.) Sacc. Syll. XI., 89 (=*Polyporus* Kalchbr. & Wettst. Bot. Leitschr. (1885) 81.

Pileus very hard, convex, dimidiate, sessile, horizontal, concentrically sulcate, irregularly tubercular, glabrous, crustaceous, copper colour, rarely fuscous when old, very shining and varnished, flesh very densely fibrillose, pliant, margin sterile, entire, very shining, reddish. Pores thin, orifice very small, round and deep ochraceous. Spores hyaline, subglobose.

Habitat. On living trunks of Cherry in Lower Austria.

Pileus 10-20 cm. across; spores 3-5 × 2-4μ.

Our member, Mr. C. G. Lloyd, of Cincinnati, informs me that he found this species fairly common in England in 1910. It is characterized by the strongly laccate surface of the pileus, similar to that found on *Fomes lucidus* Fr., the deeply coloured, compact, hard flesh and the small hyaline spores.

Fomes resinaceus (Boud.) Rea (=*Ganoderma* Boud. in litt.; *G. applanatus* Fr. Hym. Eur. 557 et Auct. plurr. Patouillard Bull. Soc. Myc. Fr. v. 72.

Large, 15-30 cm. wide, perennial? Pileus semicircular, somewhat flattened, sessile, rarely stalked or imbricate, concentrically sulcate, the primary furrows wide, becoming shallower and more crowded with age, covered with a varnished yellow, then blood red umber chestnut crust which is at first very shining, then duller and dusted with the spores; margin at first white, delicately pruinose and rounded, becoming glabrous, more acute and concolorous. Pores minute, rounded, elongate, and finally stratose, when they measure about 3 cm. in length, orifice at first white then fuscous cinnamon. Spores ovate oblong or obovate, truncate at the base, fuscous, quite smooth, epispore thick, eguttulate or one guttulate, 10-12 × 6-7μ.

Common, on trunks of Oak in old woods near Blois, Central France.

This species is easily distinguished from *G. applanatum* by its very soft consistency, smooth spores and frequent viscid surface. It differs from *G. australe* in its thick flesh and from its ally *G. carnosum* in the margin which is never hard and horny and its smooth not verrucose spores. It very closely resembles *G. lucidum* and has often been considered a sessile form of that species, but it is distinguished by its sessile growth on the trunk of the tree itself (only very rarely having a rudimentary stem), its larger size, greater thickness, softer flesh, which is more fibrous and less fine, and especially by its tubes, which are sometimes stratose, and its quite smooth spores.

On Beech, Oak, Pinus halepensis, &c., near Paris, Nantes, Marseilles, Tyrol, &c.

On Beech, Kyre Park, Worcestershire, 24th September, 1910, and on Oak, Wynnstay Park, 30th September, 1910, *C. R.* It is easily distinguished from *F. applanatus* by the more viscid, laccate surface of the pileus and lighter coloured flesh. My thanks for its determination are due to Mr. C. G. Lloyd and L'Abbé G. Bresadola.

Phlebia albida Fr. Monogr. II. 280. Hym. Eur. 625.

White. Spots orbicular becoming confluent, adnate except at the margin which is definite, *waxy coriaceous* when moist, *cartilaginous* when dry. Hymenium consisting of *simple*, elevated wrinkles irregularly dispersed over the surface. Spores white, hyaline, elliptical, obtuse at both ends, $4\text{-}5 \times 2{\cdot}5\text{-}3\mu$, one to two-guttulate.

On a fallen trunk, Stevenston Wood, Ayrshire, Mr. D. A. Boyd, 4th October, 1910.

This species is characterized by its pure white colour, simple wrinkles, and its *Corticium* like consistency which becomes cartilaginous when dry.

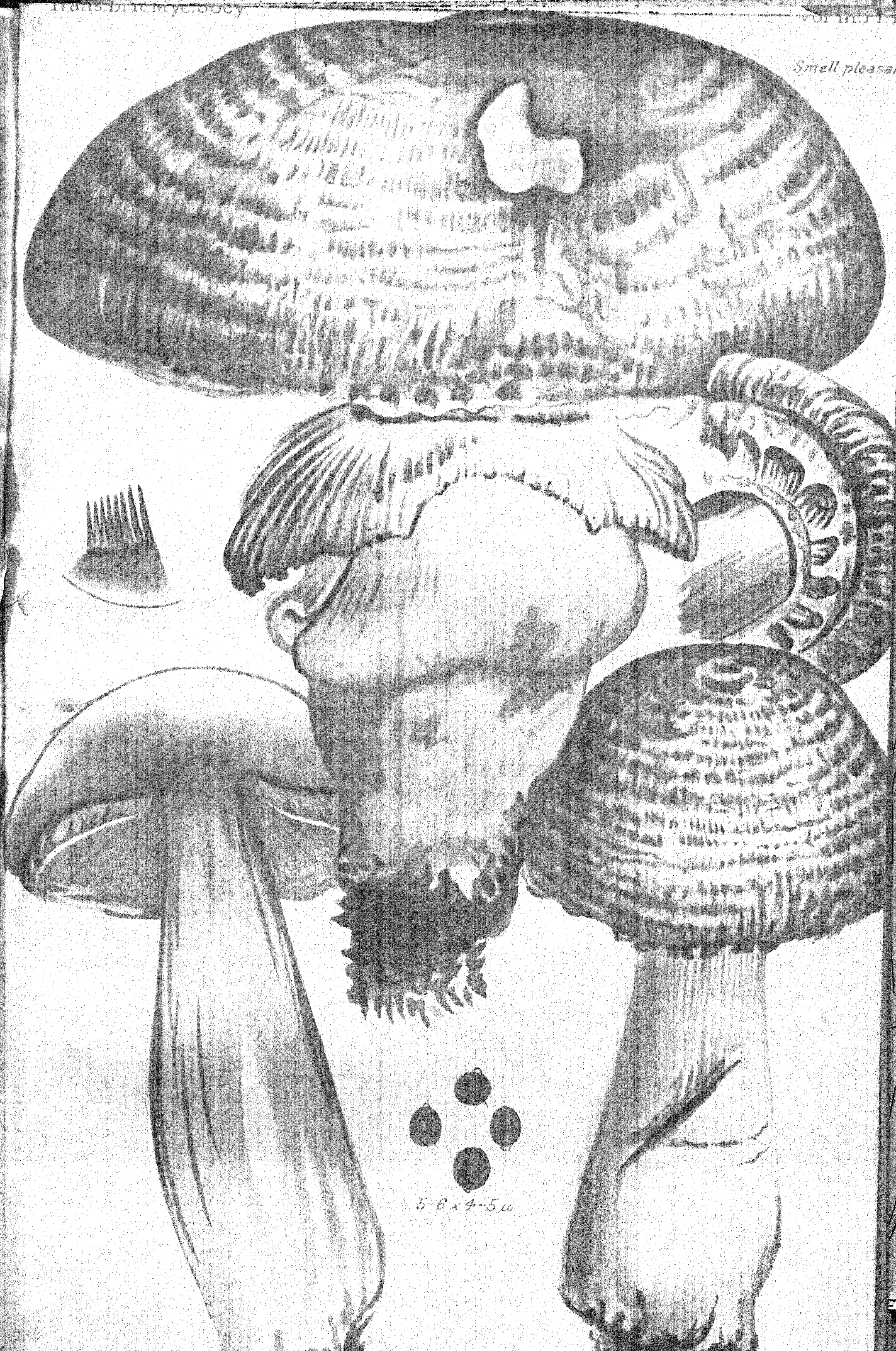
Corticium atrovirens Fr. See Trans. Brit. Myc. Soc. vol. III., pt. 3, 172.

Through the kindness of Monsieur René Maire, D.Sc., we are able to give an illustration of this rare species with microscopic detail on plate 16.

Dasyscypha flavo-fuligineum (A. & S.) Fckl. Rabh. Krypt. Flora I., 3, 888.

Ascophores scattered or gregarious, 1-3 mm. wide, sessile, globose and closed at first then becoming plane with the margin slightly raised; disc olivaceous brown or fuliginous, externally bright sulphur yellow densely villose, hairs simple, straight, obtuse, sparingly septate, almost smooth, yellow, colourless at

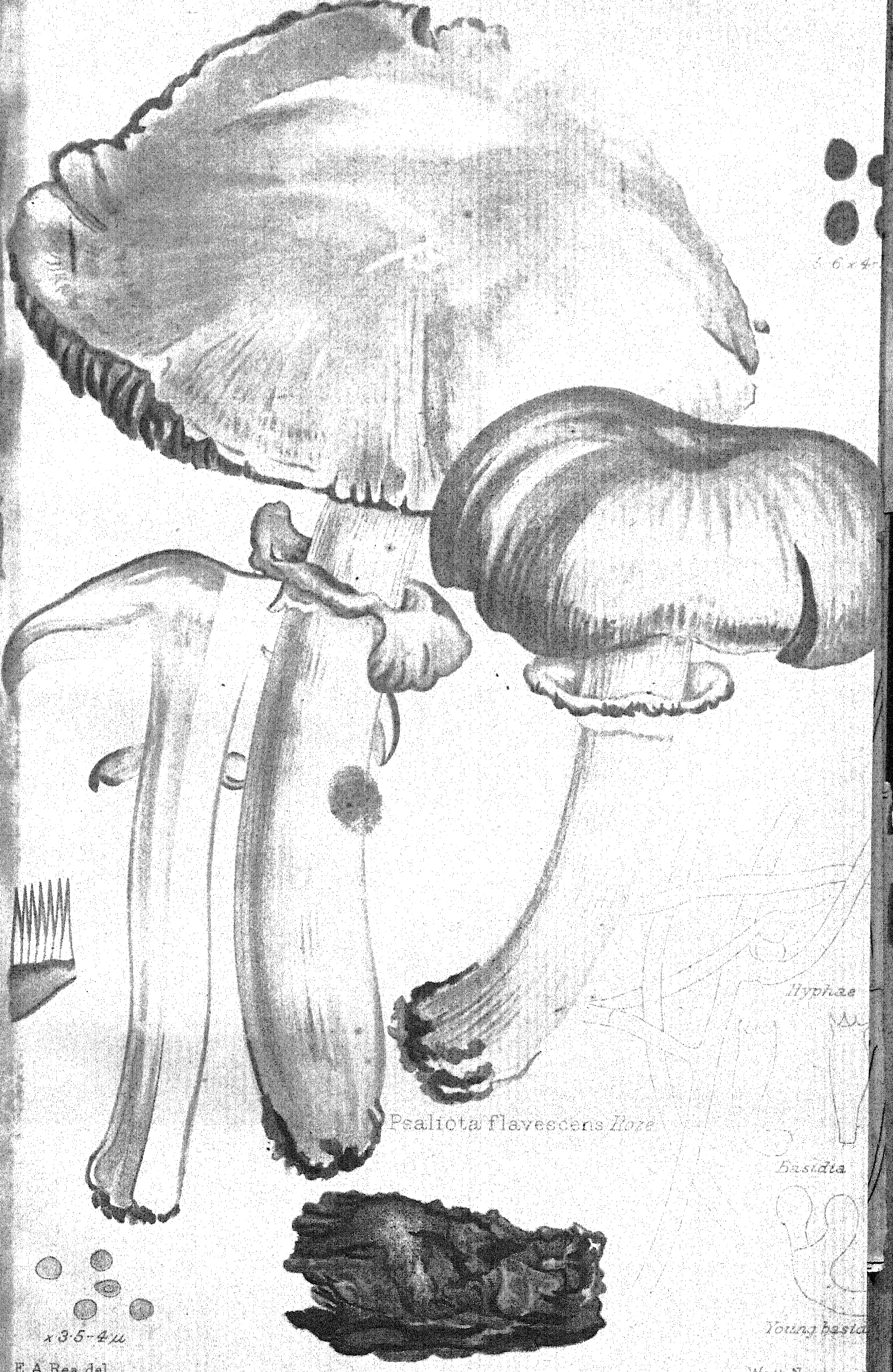
Smell pleasant



E. A. Rea del.

West, Newman ch

Psaliota exserta *Viv.*



Psaliota flavescens *Roze*

Corticium atrovirens *Fr.*

E. A. Rea del.

West, Newman c

the ends 210-370 × 3-4μ, asci cylindric clavate, rounded at the apex, 70-75 × 5-6μ, 8-spored; spores 9-11 × 2-2·5μ, subcylindrical, hyaline, continuous, straight, obtuse; paraphyses lanceolate, acute, hyaline, 80-85 × 4-5μ.

On old Elm stumps, near Perth, Mr. James Menzies, 15th December, 1910.

Cyathicula alba (Pat.) Sacc. Syll. VIII. 305. Boud. Disco. D'Eur. 116 (*Callycella alba* Pat. Tab. anal. Fung. II. 37, f. 594).

White. Ascophore stipitate, scattered, plane or slightly convex, 2-4 mm. across, glabrous, margin divided into acute, erect, distant teeth; stem ·5-·7 mm. long, attenuated downwards; asci clavate, 90-95 × 7-8μ, 8-spored; spores hyaline, fusiform, straight or curved, 9-16 × 4-4·5μ, guttulate; paraphyses linear, 1μ thick, branched, exceeding the asci.

On the side of a ditch in clay soil, near Perth, Mr. James Menzies, 10th September, 1910.

Oidium alphitoides Griff. & Maulb. Bull. Soc. Myc. de Fr. XXVI. (1910) 137. *Oidium quercinum* Maire et auct. nonnull. recent. non Thümen *Oidium quercinum* var. *gemmiparum* Ferraris.

Very densely tufted, effused, pulverulent, pure white or whitish, often confluent on the upper side of the leaf and sometimes entirely covering it, more attenuated on the under side; sterile hyphae with globose haustoria, septate, hyaline, intricate; conidiophores erect, septate ,50-90 × 5-9μ, conidia ovate or jar-shaped, obtuse at both ends, hyaline, guttulate 25-35 × 14-19μ.

On living leaves of *Quercus*. Bredon, Besford, Wyre Forest, Tiddesley Wood and Nunnery Wood, Worcestershire. This species is very common and widely distributed, it is very easily recognized by its *barrel-shaped* conidia.

Arthrobotrys superba Cda. Prachtfl., 43, pl. 21. Massee and Salmon. Ann. Bot. XVI. (1902), 83.

On damp blotting paper, Wood Green, North London, Mr. R. Finlayson, 22nd August, 1910.

OFFICERS FOR THE SEASON 1910.

President: Harold Wager, F.R.S., Hendre, Horsforth Lane, Far Headingley, Leeds.

Vice-President: Professor R. H. Biffen, M.A., The Gables, Histon, near Cambridge.

Hon. Secretary and Treasurer: Carleton Rea, B.C.L., M.A.. &c., 34, Foregate Street, Worcester.

Published the 13th of May, 1911.

THE TEESDALE FORAY.

2nd to 6th June, 1911.

The third informal spring foray of the British Mycological Society was held in Teesdale from Friday the 2nd of June to Tuesday the 6th of June, 1911. The members assembled at the Barnard Castle railway station about 6 p.m. in the afternoon of Friday, from whence they were driven to the Morritt Arms Hotel at Greta Bridge, about three miles away. The Morritt Arms was constituted the headquarters for the foray, and in the evening Mr. W. N. Cheesman and Mr. Raymond Finlayson exhibited some microscopic slides and specimens of mycetozoa.

On Saturday, the 3rd of June, Mortham Wood was explored, the most noticeable find being *Mycena flavipes* Quél. The walk was then continued past Mortham Tower to Dairy Bridge, which spans the river Greta at a picturesque spot a little distance above its confluence with the Tees. The right bank of the Tees was next carefully examined until the members arrived at the ruins of Egglestone Abbey, where some specimens of *Perichaena corticalis* (Batsch) Rost. and *Lachnea scutellata* (Linn.) Gillet were discovered on some rotting timber.

The following day an early start was made from the headquarters in order to catch the 9-20 a.m. train from Barnard Castle to Middleton in Teesdale. From Middleton the members drove to Wynch Bridge, where a halt was made, and Mr. Raymond Finlayson secured some examples of *Ombrophila brunnea* Phil. The drive was then continued to High Force, which was inspected, and Dr. J. W. Ellis gathered a few peridia of *Cyathus vernicosus* (Bull.) DC. The brake next conveyed the members to the Hotel at Langdon Beck, from whence a traverse was taken over the moors in the direction of Widdy Bank and by the side of the Tees to Watersmeet. A good many plants were found attacked by species of the Uredinaceae, including *Uromyces valerianae* (Schum.) Winter, *Puccinia caricis* (Schum.) Winter, and *Puccinia fusca* (Relhan) Winter.

On Monday, the 5th of June, the Brignall Banks were thoroughly worked. Miss E. J. Welsford found some ascophores of *Chlorosplenium aeruginosum* (Oed.) de Not and *Ombrophila brunnea* Phil. Dr. J. W. Ellis collected a *Helotium* with a green hyaline stem; this Monsieur Emile Boudier was unable to identify but he said it came near to *Helotium nubilipes* Boud.,

from which it differs in its much smaller spores and other characters. This will be subsequently described and figured under the name of *Helotium chloropodium* Rea & Ellis (see p. 379). Miss C. A. Cooper boxed a pretty specimen of the somewhat rare *Omphalia velutina* Quél., and Professor M. C. Potter brought in several pilei of *Trametes mollis* (Smrft.) Fr.

On Tuesday, the 6th of June, the members drove via Wycliffe and Winston to Staindrop, where they were joined by Mr. Thomas Bewick, Forester to the Raby Castle Estate. Under Mr. Bewick's direction a start was made in Lady Wood, where there was a considerable amount of fallen timber lying about, and Dr. J. W. Ellis discovered on a fallen oak branch some nice specimens of *Mollisia ramealis* Karst., which is an addition to the British Fungus Flora (see p. 379). After this had been carefully inspected a plantation of young Firs was visited which was found to be very badly infected with what was formerly known as *Peridermium pini* (Willd.) Chev.—the aecidial condition of *Coleosporium senecionis* (Pers.) Fr.—and with the ravages made by the larvae of the tiny moth *Argyresthia laevigatella* (H. Sch.). The walk was then continued across some fields to the gardens adjoining Raby Castle, and some quantities of *Otidea cochleata* (Bull.) Fckl. were obtained. In the evening hearty votes of thanks were passed to Mr. J. J. Bell-Irving and Lord Barnard for kind permission to go through their woods at Brignall Bank, Rokeby and Raby Castle, and to Mr. H. L. Fife and Mr. T. Bewick, the Agent and Forester to Lord Barnard, for the arrangements made to visit the Raby estate.

On Wednesday, the 7th of June, a few of the members visited Deepdale, but beyond the finding of *Puccinia bunii* (DC.) Winter in fair abundance no further addition was made to the list. Over two hundred species of fungi and nineteen species of mycetozoa were collected during the Teesdale foray, and seeing that the month of May was one of the driest and hottest that we have had for many years this may be regarded as a fairly satisfactory number. *Uromyces alchemillae* (Pers.) Winter was everywhere abundant on the leaves of Alchemilla vulgaris and transformed the underside into a beautiful golden lining.

Mr. T. Petch, B.A., B.Sc., of Peradeniya Gardens, Ceylon, was unanimously elected a member.

COMPLETE LIST OF FUNGI GATHERED DURING THE FORAY.

B = Brignall Banks; *D* = Deepdale; *H* = High Force and Wynch Bridge; *L* = Langdon Beck; *M* = Mortham Wood; *Ra.* = Raby; and *Ro.* = Rokeby.

Tricholoma gambosum Fr., *B.*
Collybia dryophila (Bull.) Fr., *B.*, platyphylla (Pers.) Fr., *Ra.*, conigena (Pers.) Fr., *Ra.*
Mycena flavipes Quél., *M.*, rugosa Fr., *B.*, *M.*, galericulata (Scop.) Fr., *B.*, *M.*, polygramma (Bull.) Fr., *B.*, *M.*, *Ra.*, galopoda (Pers.) Fr., *Ra.*, tenerrima Berk., *M.*
Omphalia velutina Quél. *B.*, integrella (Pers.) Fr., *M.*
Pleurotus ostreatus (Jacq.) Fr., *B.*
Pluteus chrysophaeus (Schaeff.) Fr., *M.*, *Ra.*
Claudopus variabilis (Pers.) W. G. Sm., *M.*
Pholiota praecox (Pers.) Fr., *B.*, *M.*, mutabilis (Schaeff.) Fr., *B.*, *M.*, *Ra.*
Inocybe petiginosa (Fr.) Quél., *Ra.*
Tubaria furfuracea (Pers.) W. G. Sm., *B.*
Crepidotus mollis (Schaeff.) Fr., *B.*, *M.*
Psaliota campestris (Linn.) Fr., *B.*, *Ra.*
Stropharia semiglobata (Batsch) Fr., *D.*
Hypholoma sublateritium (Schaeff.) Fr., *B.*, *Ra.*, capnoides Fr., *M.*, epixanthum Fr., *B.*, *M.*, fasciculare (Huds.) Fr., *Ra.*, *Ro.*
Psathyra spadiceo-grisea (Schaeff.) Fr., *M.*
Panaeolus campanulatus (Linn.) Fr., *M.*, papilionaceus (Bull.) Fr., *Greta Bridge.*
Psathyrella gracilis Fr., *B.*, *M.*, disseminata (Pers.) Fr., *B.*
Coprinus atramentarius (Bull.) Fr., *M.*, micaceus (Bull.) Fr., *B.*
Hygrophorus miniatus Fr., *B.*
Russula adusta (Pers.) Fr., *B.*, furcata (Pers.) Fr., *B.*, cyanoxantha (Schaeff.) Fr., *B.*
Marasmius calopus (Pers.) Fr., *Ra.*
Polyporus brumalis (Pers.) Fr., *Ra.*, squamosus (Huds.) Fr., *B.*, *M.*, *Ra.*, *Ro.*, varius Fr., *B.*, elegans (Bull.) Fr. var. nummularius Fr., *B.*, hispidus (Bull.) Fr., *Ra.*, nidulans Fr., *Ra.*, adustus (Willd.) Fr., *B.*, *M.*, betulinus (Bull.) Fr., *M.*, *Ra.*, caesius (Schrad.) Fr., *Ra.*

Fomes igniarius (Linn.) Fr., *B.*, nigricans Fr., *B.*, annosus Fr., *Ra.*, applanatus (Pers.) Fr., *M.*, *Ra.*, ferruginosus (Schrad.) Fr., *B.*, *M.*, *Ra.*

Polystictus versicolor (Linn.) Fr., *B.*, *M.*, radiatus (Sow.) Fr., *B.*, velutinus Fr., *B.*

Poria vaporaria (Pers.) Fr., *B.*, *M.*, obliqua (Pers.) Fr., *B.*

Trametes suaveolens (Linn.) Fr., *B.*, mollis (Smrft) Fr. *B.*, *M.*, *Ra.*

Solenia anomala (Pers.) Fr., *B.*, *M.*, *Ra.*, *Ro.*

Hydnum ochraceum (Pers.) Fr., *M.*, niveum (Pers.) Fr., *B.*

Irpex obliquus (Schrad.) Fr., *B.*, *M.*, *Ra.*, *Ro.*

Radulum quercinum Fr., *B.*, *M.*

Grandinia granulosa (Pers.) Fr., *B.*, *M.*, *Ra.*, mucida Fr., *M.*

Odontia fimbriata (Pers.) Fr., *B.*

Stereum purpureum (Pers.) Fr., *B.*, *M.*, *Ra.*, hirsutum (Willd.) Fr., *B.*, *M.*, *H.*, *Ra.*, *Ro.*, sanguinolentum (A. & S.) Fr., *Ra.*, rugosum (Pers.) Fr., *Ra.*

Hymenochaete rubiginosa (Schrad.) Lév., *M.*, *Ra.*

Corticium lacteum Fr., *B.*, *M.*, *Ra.*, arachnoideum Berk. *B.*, *M.*, sanguineum Fr., *Ra.*, calceum (Pers.) Fr., *M.*, *Ra.*

Peniophora quercina (Pers.) Cke., *M.*, cinerea (Fr.) Cke., *M.*, *Ra.*, incarnata (Pers.) Mass., *B.*

Auricularia mesenterica (Dicks.) Fr., *Ro.*

Hirneola auricula-judae (Linn.) Fr., *M.*

Exidia glandulosa (Bull.) Fr., *M.*, albida (Huds.) Bref. *B.*, *M.*

Tremella mesenterica (Retz) Fr., *B.*, sarcoides Sm., *B.*

Dacryomyces deliquescens (Bull.) Duby, *M.*, stillatus (Nees) Fr., *B.*, *M.*, *Ra.*

Sphaerobolus stellatus (Tode) Pers., *B.*

Cyathus vernicosus (Bull.) DC., *H.*

Bovista nigrescens Pers., *B.*, *Ro.*

Lycoperdon pyriforme (Schaeff.) Pers., *M.*

Uromyces geranii (DC.) Winter, *on Geranium sylvaticum*, *B.*, *L.*, valerianae (Schum.) Winter, *on Valeriana dioica*, *L.*, poae Rabh., *on Ranunculus repens*, *B.*, alchemillae (Pers.) Winter, *on Alchemilla vulgaris*, *L.*, *M.*, scillarum (Grev.) Winter, *on Scilla nonscripta*, *B.*

Puccinia praenanthis ((Pers.) Winter, *on Lactuca muralis*, *Greta Bridge*, pulverulenta Grev., *on Epilobium montanum*, *Ra.*, violae (Schum.) Wint., *on Viola Riviniana*, *H.*, primulae (DC.), Winter, *on Primula vulgaris*, *Ro.*, poarum Nielsen, *on Tussilago Farfara*, *B.*, *M.*, caricis (Schum.) Winter, *on Urtica dioica*, *L.*, Pringsheimiana Kleb. (=Aecidium grossulariae), *on Ribes Grossularia*, *Greta Bridge*, suaveolens (Pers.) Winter, *on Cnicus arvensis*, *B.*, *Ro.*, hieracii (Schum.) Winter, *on Hieracium vulgatum*, *B.*, fusca (Relhan) Winter, *on Anemone*

nemorosa, L., bunii (DC.) Winter, *on Conopodium majus, D.*, senecionis Lib., *on Senecio aquaticus, B.*, malvacearum Mont., *on Malva sylvestris, Ro.*

Triphragmium ulmariae (Schum.) Winter, *on Spiraea ulmaria, Ro.*

Phragmidium fragariastri (DC.) Schröt., *on Potentilla fragariastrum, B.*, subcorticatum (Schrank) Schröt., *on Rosa canina, Greta Bridge, Ra.*

Xenodochus carbonarius Schlecht., *on Poterium officinale, H.*

Melampsora rostrupii Wagner (= Caeoma mercurialis), *on Mercurialis perennis, B., M.*

Coleosporium senecionis (Pers.) Fr., *on Pinus, Ra.*, petas...s de Bary, *on Petasites ovatus, Ra.*

Ustilago violacea (Pers.) Winter, *on Lychnis dioica, M., Ro.*

Urocystis occulta (Wallr.) Schröt., *on Agropyrum, B.*, anemones (Pers.) Schröt., *on Ranunculus repens, Ro.*, violae (Sow.) Schröt., *on Viola sylvestris, Ra.*

Sphaerotheca pannosa (Wallr.) Lév., *H., Ro.*

Erysiphe graminis (DC.) Fr., *Ra.*

Capnodium salicinum (A. & S.) Mont., *Ra.*

Nectria episphaeria (Tode) Fr., *B., M., Ra.*, cinnabarina (Tode) Fr., *Ra.*, coccinea (Pers.) Fr.

Hypomyces rosellus (A. & S.) Tul., *on Polyporus adustus, M., Ra.*

Epichloe typhina (Pers.) Fr., *B., D.*

Cordyceps militaris (Linn.) Fr., *M.*

Lasiosphaeria hirsuta (Fr.) Ces. & de Not., *M.*

Leptospora ovina (Pers.) Fckl., *Ra.*, strigosa (A. & S.) Fckl., *Ro.*

Chaetosphaeria phaeostroma (Dur. & Mont.) Fckl., *Ra.*

Rosellinia aquila (Fr.) de Not., *B., M.*

Bertia moriformis (Tode) de Not., *B., M., Ra.*

Melanomma pulvispyrius (Pers.) Fckl., *B., M., Ra.*, aspegrenii (Fr.) Fckl., *B.*

Venturia rumicis (Desm.) Winter, *Ro.*

Leptosphaeria vagabunda Sacc., *on Ribes Grossularia, Ro.*, acuta (Moug. & Nestl.) Karst., *B., M., Ra.*

Laestadia punctoidea (Cke.) Auersw., *B., D.*

Pleospora herbarum (Pers.) Rabh., *B.*

Ophiobolus acuminatus (Sow.) Duby, *B.*

Hypospila pustula (Pers.) Karst., *Ra.*

Diaporthe pulla Nitschke, *on Hedera Helix, L.*

Eutypa lata (Pers.) Tul., *B., M., Ra.*

Cryptosphaeria eunomia (Fr.) Fckl., *B.*

Melanconis stilbostoma (Fr.) Tul., *B., Ra.*

Diatrypella quercina (Pers.) Nitschke, *M.*, favacea (Fr.) Nitschke *B.*

Diatrype stigma (Hoffm.) de Not., *B., M., Ra.*, disciformis (Hoffm.) Fr., *B., M.*, nigroannulata (Grev.) Nitschke.

Hypoxylon multiforme Fr., *B.*, *Ro.*, fuscum (Pers.) Fr., *B.*, *M.*, *Ra.*
Ustulina vulgaris Tul., *B.*, *M.*, *Ra.*
Xylaria hypoxylon (Linn.) Grev., *B.*, *M.*, *Ra.*, carpophila (Pers.) Fr., *M.*, bulbosa (Pers.), B. & Br., *B.*
Phyllachora graminis (Pers.) Fckl., *Ro.*, junci (Fr.) Fckl., *H.*, *Ra.*
Dothidella betulina (Fr.) Sacc., *Ra.*
Morchella ? esculenta (Linn.) Fr., *Ro.*
Leotia acicularis (Pers.) Phil., *H.*
Otidea cochleata (Bull.) Fckl, *Ra.*
Humaria omphalodes (Bull.), Mass., *M.*, granulata (Bull.) Sacc., *Ro.*
Dasyscypha virginea (Batsch) Fckl., *B.*, *M.*, *Ro.*, nivea (Hedwig Fil.) Mass., *Ro.*, *Ra.*, nidulus (Schm. & Kunze) Mass., *on Spiraea ulmaria*, *B.*, acutipila (Karst.) Sacc., *M.*, tricolor (Sow.) Mass., *Ro.*, hyalina (Pers.) Mass., *B.*, *Ra.*
Lachnea scutellata (Linn.) Gillet, *Egglestone Abbey.*
Tapesia fusca (Pers.) Fckl., *B.*, *Ra.*, caesia (Pers.) Fckl., *B.*, *Ro.*
Chlorosplenium aeruginosum (Oed.) de Not., *B.*
Helotium claroflavum (Grev.) Berk., *Ro.*, aureum (Pers.) Fr., *Ra.*, virgultorum (Vahl.) Karst., *B.*, *M.*, calyculus (Sow.) Berk., *Ra.*, cyathoideum (Bull.) Karst., *B.*, *H.*, *Ra.*, chloropodium Rea & Ellis, herbarum (Pers.) Fr., *B.*, fagineum (Pers.) Fr., *M.*, *Ra.*
Mollisia cinerea (Batsch) Karst., *B.*, *M.*, *Ra.*, melaleuca (Fr.) Sacc., *B.*, *D.*, *Ro.*, dentata (Pers.) Gillet, *L.*, ramealis Karst., *Ra.*
Ascobolus furfuraceus (Pers.) Fr., *Ro.*
Coryne sarcoides (Jacq.) Tul., *Ra.*
Orbilia rubella (Pers.) Karst., *B.*, leucostigma (Fr.) Fr., *B.*, *H.*, *M.*, *Ra.*
Ombrophila brunnea Phil., *B.*, *H.*
Heterosphaeria patella Grev., *L.*
Propolis faginea Karst., *B.*, *M.*
Rhytisma acerinum (Pers.) Fr., *D.*, *H.*, *M.*
Trochila ilicis (Fr.) Crouan, *Ra.*, *Ro.*
Dichaena quercina (Pers.) Fr., *M.*, *Ra.*
Hysterium angustatum (A. & S.) Fckl., *B.*
Pycnochytrium mercurialis (Lib.) Schröt., *on Mercurialis perennis*, *B.*, *M.*
Pilobolus crystalinus (Wiggers) Coemans, *Ro.*
Mucor racemosus Fres., *M.*
Peronospora pusilla de Bary, *on Geranium sylvaticum*, *M.*
Phoma nebulosum (Pers.) Berk., *on Urtica dioica*, *B.*; complanata (Tode) Desm., *on Angelica sylvestris*, *B.*
Actinonema rosae (Lib.) Fr., *Ro.*

Aspergillus glaucus (Linn.) Fr., *Ra.*, *Ro.*
Penicillium crustaceum (Linn.) Fr., *Ro.*
Rhinotrichum aureum C. & M., *M.*, *Ra.*
Ramularia calcea Ces., *on Nepeta glechoma*, *M.*
Stilbum tomentosum (Schr.) Fr., *M.*

*Mycetozoa.**

Ceratiomyxa fruticulosa (Muell.) Macbr. (Syn. C. mucida (Pers.) Schroet.), *Ra.*
Craterium leucocephalum (Pers.) Ditm., *Ro.*
Didymium squamulosum (Alb. & Schw.) Fr. (Syn. D. effusum Link), *B.*, *Ra.*
Stemonitis fusca Roth, *B.*, *Ro.*
Comatricha obtusata Preuss, *B.*, *M.*, typhoides (Bull.) Rost., *M.*
Reticularia Lycoperdon Bull., *B.*, *M.*
Trichia affinis de Bary, *Ra.*, persimilis Karst., *M.*, scabra Rost., *M.*, decipiens (Pers.) Macbr. (Syn. T. fallax Pers.), *M.*, Botrytis Pers., *B.*, *Ra.*
Hemitrichia Vesparium (Batsch) Macbr. (Syn. H. rubiformis (Pers.) List.), *M.*, clavata Rost., *B.*
Arcyria denudata (Linn.) Sheldon (Syn. A. punicea Pers.), *B.*, *M.*, incarnata Pers., *B.*, *M.*
Perichaena depressa Lib., *M.*, corticalis (Batsch) Rost. (Syn. P. populina Fr.), *B.*, *Egglestone Abbey.*
Lycogala epidendrum (Linn.) Fr. (Syn. L. miniatum Pers.), *B.*, *Ro.*

* These were kindly confirmed by our members Miss Gulielma Lister and Mr. W. B. Allen.

THE TAUNTON FORAY.

18th to the 23rd September, 1911.

The fifteenth annual week's fungus foray of the British Mycological Society was held at Taunton on the invitation of the Somersetshire Archaeological and Natural History Society. On Monday the 18th of September, 1911, the members assembled at the Castle Hotel, Taunton, and proceeded to their headquarters, the Museum, Taunton Castle, where the Somersetshire Club most kindly placed at their disposal rooms for the exhibition of specimens and the reading of papers. About five o'clock Mr. C. Tite and Mr. H. St. George Gray (Vice-President and Secretary of the Taunton Field Club) on behalf of the Taunton Field Club welcomed the following members on their visit to Taunton: Professor E. S. Salmon, F.L.S. (President), the Vice-President Professor M. C. and Mrs. Potter, Professors T. Petch and A. H. R. Buller; the Misses A. Lorrain Smith, Gulielma Lister, H. C. I. Fraser, C. A. Cooper, J. S. Bayliss, A. Hibbert-Ware, E. M. Wakefield, Mrs. C. D. Harvey, Mr. and Mrs. F. T. Brooks, Drs. J. W. Ellis and A. Adams, Messrs. A. D. Cotton, J. A. Ramsbottom, W. Norwood Cheesman, E. W. Swanton, R. Finlayson, C. Otto Blagden, C. P. Bird, D. Mackenzie, N. G. Hadden, A. A. Pearson, M. A. Bailey, C. J. Sharpe, S. R. Price, and Mr. and Mrs. Carleton Rea. After tea had been partaken of, Mr. E. W. Swanton delivered a very interesting popular lecture on the larger fungi (illustrated by many excellent lantern slides). The object of this paper was to urge the present members of the Somersetshire Natural History Societies to take an interest in the study of our fungi and to continue the investigation of the county fungus flora. With regard to this latter point Mr. E. W. Swanton stated that no less than three hundred and forty-two species of fungi had been recorded for Somersetshire that were either new British records or new to science, and that the first list of Somersetshire fungi, which included six hundred and twenty-seven species, was published in 1852, by the Rev. W. R. Crotch, in the Proceedings of the Somersetshire Archaeological and Natural History Society in a paper entitled "A List of Fungi found in the neighbourhood of Bristol, Bath and Taunton, furnished by H. O. Stephens, Bristol, C. Broome, Batheaston, and W. R. Crotch, Taunton."

On the conclusion of the paper hearty votes of thanks were passed to Mr. E. W. Swanton for his interesting address and to the Taunton Field Club for their kind hospitality.

On Tuesday, the 19th of September, an early start was made from the railway station at eight o'clock for Dunster, where the members arrived shortly after nine o'clock. Mr. A. F. Luttrell kindly met the members at the railway station and at once conducted them to Conegar Wood, which was found to be in a very dry condition, and *Boletus parasiticus* (Bull.) Fr. and *Polyporus sulphureus* (Bull.) Fr. (the latter growing on *Populus tremula*) were the only finds worthy of note. The walk was continued to the Home Park, where some nice examples of *Fomes resinaceus* (Boud.) Rea were obtained. This Fomes was only added to the British list last year and a full description of it is set out in the last part of the British Mycological Society's Transactions, vol. III., p. 287. From the Home Park the members wended their way to the grounds of Dunster Castle, and from thence to Fair Oak Wood and the Deer Park. The most interesting fungi collected were *Pholiota dura* (Bolt.) Fr. (a caespitose form), *Collybia longipes* (Bull.) Fr., *Polyporus Schweinitzii* Fr., *Hydnum udum* Fr., *Porothelium confusum* B. & Br., *Cyphella villosa* (Pers.) Karst., *Clavaria umbrinella* Sacc., *Femsjonia luteo-alba* Fr., *Phragmidium* (=*Chrysomyxa*) *albidum* (Kühn) Ludw., and *Ascobolus viridulus* Phil. & Plow. gathered by Miss A. Lorrain Smith.

In the evening, at the headquarters at nine o'clock, the President (Professor E. S. Salmon, F.L.S.) took the chair, and the following officers were unanimously elected for the ensuing year:—Miss Gulielma Lister, F.L.S., President; Professor M. C. Potter, Sc.D., M.A., F.L.S., Vice-President; and Mr. Carleton Rea, B.C.L., M.A., &c., Hon. Secretary and Treasurer. The Hon. Secretary reported that he had received a contribution from Monsieur Emile Boudier for insertion in the next number of the Transactions entitled "Note sur le Pseudophacidium Smithianum" (see page 324). Letters regretting their inability to attend the meeting had been received from the Rev. W. L. W. Eyre, Messieurs W. B. Allen, D. P. Goodwin, E. M. Holmes, René Maire, Harold Wager, and Dr. H. Drinkwater. An invitation from Mr. D. A. Boyd was next considered suggesting that a joint foray should be held in 1912 in conjunction with the Cryptogamic Society of Scotland. This was unanimously agreed to and the *place of meeting was to be left to the Scotch Society, but it was also determined that the date of the meeting must be arranged for from Thursday the 12th of September to Thursday the 19th of September, 1912, so that

* This is now fixed at Forres for these dates.

the autumn foray might follow on immediately after the meeting of the British Association at Dundee. Miss A. Lorrain Smith was appointed the delegate to represent the British Mycological Society at the meeting of the British Association at Dundee in 1912. The Hon. Secretary next read on behalf of their outgoing President (Mr. Harold Wager, F.R.S.) a paper entitled "The Study of Fungi by Local Natural History Societies" (see p. 325), which he had read as their delegate before the Conference of Delegates of Corresponding Societies of the British Association at their last meeting at Portsmouth. Many members who had attended the Portsmouth meeting joined in the discussion of this paper and reported that a general wish was expressed at that meeting that some guidance should be given by the British Mycological Society to Local Natural History Societies in their study of the fungi occurring in their districts. It was accordingly resolved "that a committee consisting of the executive officers, Miss A. Lorrain Smith, and Mr. A. D. Cotton, should draw up a circular to be sent out to the various Natural History Societies, which should embody some of the suggestions dealt with by our delegate at the Portsmouth meeting." In pursuance of this resolution the following circular was subsequently sent out to the Secretaries of over a hundred Natural History Societies:—

THE BRITISH MYCOLOGICAL SOCIETY.

Recognosce notum, ignotum inspice.

At the last Meeting of the British Association, held at Portsmouth, a paper was read by our delegate and past-president, Mr. Harold Wager, F.R.S., on "The Study of Fungi by Local Natural History Societies," when a wish was expressed that some guidance should be given by the British Mycological Society to Local Natural History Societies in their study of the fungi occurring in their districts. In pursuance of this desire a committee of the British Mycological Society have drawn up the following questions for their consideration:—

I. The very serious disease known as "Silver-leaf" (so called because the leaves become of a "silvery" colour) which affects fruit trees, particularly the "Victoria" plum, is now thought to be caused probably by *Stereum purpureum*, the sporophores of which appear on the dead wood of the affected trees. Observations on the following points would be valuable:—

(a) The distribution of *Stereum purpureum* as a *parasite* or *saprophyte* in the district.
(b) *The habitat*, with exact identification of the dead tree, shrub, or wood on which the sporophores are found.
(c) Did "silvery" foliage occur on the tree or shrub previous to the occurrence of the sporophores on the dead wood?

Should any difficulty be found in identifying this fungus, specimens should be sent for determination to our President, Professor E. S. Salmon, F.L.S., South-Eastern Agricultural College, Wye, Kent.

II. Many British trees are greatly injured by the growth of fungi belonging to the Polyporaceae. Information is wanted as to:—

(a) The name of the tree affected; and
(b) The name of the Polypore causing the injury.

In the event of the Local Society being unable to determine the Polypore, specimens, with the name of the tree on which they grew, should be forwarded for identification to Mr. Carleton Rea, 34, Foregate Street, Worcester.

III. A revision of the British Clavariaceae is being made by Mr. A. D. Cotton, F.L.S., of The Herbarium, Royal Gardens, Kew, who would be much obliged if members of Local Natural History Societies would kindly forward to him at the above address specimens of this order for identification and examination.

The Committee of The British Mycological Society would also be much obliged if the Secretaries of Local Natural History Societies would kindly inform them as to the number of their members interested in the study of mycology, and what lists of fungi or papers dealing therewith have been published by their Society.

(Signed) E. S. SALMON, F.L.S., President.
M. C. POTTER, Sc.D., M.A., Vice-President.
GULIELMA LISTER, F.L.S., President Elect.
A. LORRAIN SMITH, F.L.S.
A. D. COTTON, F.L.S.
CARLETON REA, B.C.L., M.A., &c., Hon. Secretary,
34, Foregate Street, Worcester.

11th Nov., 1911.

The Hon. Treasurer reported that their credit balance at the post office savings bank at that date amounted to £33. 3s. 2d.; that their members now numbered one hundred, and that twelve new members had been elected since their last autumn foray, namely: Mr. William Evans, F.R.S.E., 38, Morningside Park, Edinburgh; Miss Charlotte A. Cooper, The Vicarage, Robin Hood's Bay; Miss E. M. Wakefield, The Herbarium, Royal Botanic Gardens, Kew; Mr. Harold J. Wheldon, 60, Hornby Road, Walton, Liverpool; Le Jardin botanique de l'état, Bruxelles; Miss E. M. Berridge, B.Sc., 7, The Knoll, Beckenham, Kent; Mr. T. Petch, B.A., B.Sc., Royal Botanic Gardens, Peradeniya, Ceylon; Miss Jessie S. Bayliss, D.Sc., Lecturer and Demonstrator in Botany, Birmingham University; Mr. Arthur A. Pearson, 3, North View, Wimbledon Common; Mr. Norman G. Hadden, St. Audreys, Priory Road, Malvern; Mr. Maurice A. Bailey, John Innes Horticultural Institute, Mostyn Road, Merton, Surrey; Mr. S. Reginald Price, B.A., Fernleigh, Wellington, Somerset. The following were then duly elected members: Miss Alice Hibbert-Ware, 23, Fladgate Road, Leytonstone, Essex; Mr. A. W. Borthwick, D.Sc., Royal Botanic Garden, Edinburgh; Professor Reginald W. Phillips, M.A., D.Sc., F.L.S., Professor of Botany in University College, Bangor; and Professor A. H. R. Buller, D.Sc., Ph.D., F.R.S.C., Professor of Botany at the University of Manitoba, Winnipeg, Canada.

On Wednesday, the 20th of September, the morning was devoted to placing out on exhibition the specimens collected on the previous day. At noon the members departed in brakes to Staple Fitzpaine, where the woods and adjoining pastures were explored by kind permission of Viscount Portman and Mr. A. E. Newton. These woods were in a very dry condition after the

long drought, but notwithstanding this some interesting examples of *Mycena Iris* Berk., *Boletus candicans* Fr. and *Polyporus rufescens* (Pers.) Fr. were found. Later in the afternoon better hunting ground was found in a lower situation near to some fish pools where there was a fair quantity of fallen timber lying about, and here two interesting species were discovered, the one new to science, *Phaeotremella pseudofoliacea* Rea (see p. 377), and the other an addition to the British Fungus Flora, *Hypocrea lactea* Fr. The members had now scattered in all directions, and after a somewhat weary tramp along the dusty roads the brakes finally picked them all up for the return journey.

In the evening, after the Club dinner at the Castle Hotel, at which several of the Somersetshire members attended, Professor E. S. Salmon delivered his presidential address on "Economic Mycology and some of its problems" (see page 310).

On Thursday, the 21st of September, the morning was spent in critically examining the specimens with the aid of books and microscopes. At eleven o'clock the brakes were entered for Triscombe Stone, the well known rendezvous for the opening meeting of the Stag Hounds. Here the adjacent woods were traversed by kind permission of the Hon. Mrs. Trollope, Major Belfield, and Mr. E. A. V. Stanley. This was the first portion of the lovely Quantock country to be visited by the Club, and the conditions were found to be much damper than on the previous days. The most noteworthy finds included *Coprinus plicatiloides* Buller (fide Professor Buller), *Femsjonia luteo-alba* Fr., *Hydnum membranaceum* (Bull.) Fr., *Corticium porosum* B. & C., *Tapezia eriobasis* (Berk.) Phil., *Pleurotus acerosus* Fr., *Helotium alniellum* (Nyl.) Karst., *Ciboria pseudotuberosa* (Rehm) Sacc., *Hydnum udum* Fr., *Hymenochaete fuliginosa* (Pers.) Lév., *Naucoria erinacea* Fr. (better placed by Quélet under *Pholiota erinacea* (Fr.) Quél.), *Coprinus stercorarius* (Bull.) Fr. (fide Professor Buller), and numerous puzzling aberrant forms were afterwards determined to be conditions of *Phlebia radiata* Fr.

In the evening at nine o'clock, at the headquarters, Professor A. H. R. Buller, D.Sc., Ph.D., F.R.S.C., gave an extemporary address (illustrated with some beautiful lantern slides) on "The Production and Liberation of Spores in the genus Coprinus" (see page 348), and at the end of this dissertation he supplemented his remarks with regard to the collection of specimens of Coprini, which he suggested should be dried along with their subjacent mycelia with the host material, and this could subsequently be revived and studied by students of this group. It is hoped that all our members will assist Professor Buller in his study of this genus and forward to him material so treated. The President then stated that several members had suggested

that no decision had been made as to the holding of a spring foray at Whitsuntide in 1912, and after some discussion it was decided to hold one at Worcester from the 24th to the 29th of May, 1912.

On Friday, the 22nd of September, after the specimens collected on the previous days had been dealt with, a start was made at 11-30 for Buncombe Cross Roads, where kind permission to visit their woods had been obtained from Messieurs W. B. Broadmead and C. E. J. Esdaile. These woods were found to be rather dry and only a few additions were noted, namely, *Cortinarius (Phlegmacium) triumphans* Fr., *Phlebia vaga* Fr., *Paxillus giganteus* (Sow.) Fr., and *Corynella glabrovirens* Boud.

In the evening at nine o'clock, at the headquarters, Mr. T. Petch, B.A., B.Sc., read a paper on "European Fungi in the Tropics; some notes on existing records" (see page 340), and Mr. Carleton Rea, B.C.L., M.A., &c., read a paper on "Our British Geasters" (see page 351) which was illustrated by his wife's most excellent paintings in water colour and also by his own private collection of dried specimens. This paper it was resolved should be printed accompanied by as many reproductions as possible. The President then stated that this concluded the business of the meeting, and afterwards hearty votes of thanks were accorded to Viscount Portman, Messieurs A. F. Luttrell, A. E. Newton, the Hon. Mrs. Trollope, Major Belfield, E. A. V. Stanley, W. B. Broadmead, and C. J. Esdaile, for kind permission to visit their estates and woods; to the Somersetshire Archaeological and Natural History Society and their members for kindly placing their microscopes and rooms at the Castle Museum at their disposal; to the Taunton Field Club for their kind hospitality; to Mr. H. St. George Gray for his assiduous attention in seeing after the best interests of the members, and to Mr. W. D. Miller and their fellow member Mr. E. W. Swanton for the excellent arrangements made by them for the foray at Taunton. Over three hundred and twenty species and varieties of fungi and twenty-six species of mycetozoa and one variety were identified during the foray. Some eighteen weeks of drought had prevailed before the visit to Taunton, so this record must be accepted as a very satisfactory one for this exceptionally dry and hot year. It is a remarkable fact that notwithstanding the arid conditions of our pastures everywhere mushrooms have been in fair abundance whilst other pasture-loving species have been almost entirely absent. Is the mycelium biennial or perennial in the former and only annual in the latter? If so, perhaps some of the members will undertake experiments to elucidate these points. Specimens of *Femsjonia luteo-alba* Fr. were met with in fair abundance on most of the days during the foray, and as this was met with pretty frequently

at the Exeter foray it may be presumed that this species is more common in the south-western portion of England than elsewhere in Britain.

COMPLETE LIST OF FUNGI GATHERED DURING THE FORAY.

B. = Buncombe; *D.* = Dunster; *S.* = Staple Park; *T.* = Triscombe Stone.*

Amanita phalloides (Vaill.) Fr., *B.*, mappa (Batsch) Fr., *T.*, muscaria (Linn.) Fr., *T.*, rubescens Fr., *D.*

Amanitopsis vaginata (Bull.) Roze, *S.*, fulva (Schaeff.) W. G. Sm., *D.*

Lepiota cristata (A. & S.) Fr., *D.*

Armillaria mellea (Vahl.) Fr., *T.*

Tricholoma rutilans (Schaeff.) Fr., *D.*

Clitocybe odora (Bull.) Fr., *B.*, candicans (Pers.) Fr., *B.*, infundibuliformis (Schaeff.) Fr., *T.*

Laccaria laccata (Scop.) Berk. & Br., *T.*, var. amethystina (Vaill.) B. & Br., *T.*

Collybia radicata (Relh.) Fr. *B.*, longipes (Bull.) Fr., *D.*, platyphylla Fr., *T.*, fusipes (Bull.) Fr., *D.*, maculata (A. & S.) Fr., *D.*, *T.*, aquosa (Bull.) Fr., *B.*

Mycena pelianthina Fr., *D.*, Iris Berk., *S.*, rubromarginata Fr., *D.*, lactea (Pers.) Fr., *B.*, rugosa Fr., galericulata (Scop.) Fr., polygramma (Bull.) Fr., *B.*, *D.*, atrocyanea (Batsch) Fr., *T.*, alcalina Fr., ammoniaca Fr., *S.*

Mycena metata Fr., *B.*, peltata Fr., *S.*, filopes Fr., *D.*, *S.*, debilis Fr., *T.*, amicta Fr., *S.*, hematopoda (Pers.) Fr., *T.*, sanguinolenta (A. & S.) Fr., *T.*, galopoda (Pers.) Fr., *B.*, *T.*, leucogala Cke., *T.*, clavicularis Fr., *S.*, tenerrima Berk., *B.*, discopoda Lév., *T.*

Omphalia camptophylla Berk., *T.*

Pleurotus acerosus Fr., *T.*, applicatus (Batsch) Fr., *B.*

Pluteus cervinus (Schaeff.) Fr., *D.*

Entoloma sinuatum Fr., *S.*

Nolanea pisciodora (Ces.) Fr., *B.*, *S.*

Claudopus variabilis (Pers.) W. G. Sm., *B.*, *T.*

Pholiota dura (Bolt.) Fr., *D.*, aegerita (Brig.) Fr., *D.*, mutabilis (Schaeff.) Fr., *B.*

Inocybe geophylla (Sow.) Fr., *B.*, var. violacea Pat., *B.*, petiginosa (Fr.) Quél., *T.*

*Where no initial is given in the following list the species was found in all or nearly all the places visited.

Hebeloma fastibile Fr., *Near Taunton.*
Naucoria erinacea Fr., *T.*, escharoides Fr., *T.*
Galera tenera (Schaeff.) Fr., hypnorum (Schrank) Fr., *D.*, *T.*
Tubaria furfuracea (Pers.) W. G. Sm., *T.*, paludosa Fr., *T.*, inquilina (Fr.) W. G. Sm., *T.*
Crepidotus mollis (Schaeff.) Fr., *D.*
Psaliota campestris (Linn.) Fr.
Stropharia stercoraria Fr., *B.*, semiglobata (Batsch) Fr.
Hypholoma sublateritium (Schaeff.) Fr., *D.*, *S.*, capnoides Fr., *B.*, *S.*, epixanthum (Paul.) Fr., *D.*, fasciculare (Huds.) Fr., pyrotrichum (Holmsk.) Fr., *B.*, *T.*, velutinum (Pers.) Fr., hydrophilum (Bull.) Fr., *T.*
Psilocybe ericaea (Pers.) Fr., *T.*, bullacea (Bull.) Fr., *T.*
Psathyra corrugis (Pers.) Fr.
Anellaria separata (Linn.) Karst.
Panaeolus campanulatus (Linn.) Fr.
Psathyrella gracilis (Pers.) Fr., atomata Fr., crenata (Lasch.) Fr., *T.*
Coprinus atramentarius (Bull.) Fr., *T.*, cinereus Fr., *B.*, niveus Fr., micaceus (Bull.) Fr., *T.*, radiatus (Bolt.) Fr., *B.*, *T.*, stercorarius (Bull.) Fr., *T.*, ephemerus (Bull.) Fr., *T.*, plicatilis (Curt.) Fr., plicatiloides Buller, *T.*
Cortinarius (Phlegmacium) triumphans Fr., *B.*
Paxillus giganteus (Sow.) Fr., *B.*, involutus (Batsch) Fr., *T.*
Lactarius turpis (Weinm.) Fr., *T.*, blennius Fr., *B.*, pyrogalus (Bull.) Fr., *D.*, vellereus (Scop.) Fr., *D.*, *S.*, quietus Fr., *T.*, rufus (Scop.) Fr., *T.*, fuliginosus Fr., *T.*, mitissimus Fr., *T.*, subdulcis (Bull.) Fr.
Russula nigricans (Bull.) Fr., *D.*, atropurpurea (Krombh.) Fr., *D.*, rubra (DC.) Fr., *T.*, cyanoxantha (Schaeff.) Fr., foetens (Pers.) Fr., *D.*, ochroleuca (Pers.) Fr., *T.*, fragilis (Pers.) Fr., *S.*, var. violacea Cke., *T.*, roseipes Bres., *S.*, lutea (Huds.) Fr., *D.*, pulchralis Cke., *T.*
Cantharellus aurantiacus (Wulf) Fr., *B.*, *D.*, *T.*, var. pallidus Cke., *T.*
Marasmius oreades (Bolt.) Fr., erythropus (Pers.) Fr., *T.*, calopus (Pers.) Fr., *T.*, ramealis (Bull.) Fr., *B.*, *S.*, rotula (Scop.) Fr., *B.*, androsaceus (Linn.) Fr., *T.*
Lentinus cochleatus (Pers.) Fr., *B.*, *S.*
Panus stypticus (Bull.) Fr., *S*,. *T.*
Lenzites betulina (Linn.) Fr., *D.*, *T.*
Boletus elegans (Schum.) Fr., *D.*, badius (Linn.) Fr., *D.*, *T.*, subtomentosus (Linn.) Fr., *B.*, *D.*, parasiticus (Bull.) Fr., *D.*, candicans Fr., *S.*, luridus (Schaeff.) Fr., *D.*, laricinus Berk., *D.*, versipellis Fr., *T.*, scaber (Bull.) Fr., *B.*, *D.*
Fistulina hepatica (Huds.) Fr.
Polyporus Schweinitzii Fr., *D.*, rufescens (Pers.) Fr., *S.*,

squamosus (Huds.) Fr., nummularius Fr., *B.*, giganteus (Pers.) Fr., *B.*, sulphureus (Bull.) Fr., fragilis Fr., *D.*, caesius (Schrad.) Fr., *T.*, adustus (Willd.) Fr., *S.*, *T.*, hispidus (Bull.) Fr., *D.*, dryadeus (Pers.) Fr., *D.*, betulinus (Bull.) Fr., *T.*, albidus (Schaeff.) Bres., *D.*, *S.*, *T.*

Fomes ulmarius (Sow.) Fr., applanatus (Pers.) Wallr., *D.*, *T.*, resinaceus (Boud.) Rea, *D.*, pomaceus (Pers.) Fr., *T.*, ferruginosus (Fr.) Massee, annosus Fr., *D.*

Polystictus perennis (Linn.) Fr., *T.*, radiatus (Sow.) Fr., *D.*, versicolor (Linn.) Fr., hirsutus (Schrad.) Fr., *S.*, velutinus (Pers.) Fr., *D.*, abietinus (Dicks.) Fr., *D.*

Poria vaporaria Pers., *T.*, aneirina (Somm.) Fr., *T.*, armeniaca Berk., *S.*, blepharistoma B. & Br., *T.*, terrestris (DC.) Fr., *S.*

Trametes mollis (Somm.) Fr., *D.*

Daedalea quercina (Linn.) Fr., *B.*, *D.*

Merulius corium Fr., *B.*

Porothelium confusum B. & Br., *D.*

Hydnum membranaceum (Bull.) Fr., *T.*, ochraceum Gmel., *D.*, aureum Fr., alutaceum Fr., *D.*, *S.*, *T.*, udum Fr., *B.*, *D.*, *T.*, niveum (Pers.) Fr., *D.*, farinaceum (Pers.) Fr., *T.*

Irpex obliquus (Schr.) Fr.

Radulum quercinum (Pers.) Fr., *D.*

Phlebia merismoides Fr., *T.*, radiata Fr., *T.*, *S.*, vaga Fr., *B.*

Grandinia granulosa (Pers.) Fr., *D.*, mucida Fr., *T.*

Odontia barba-jovis (Bull.) Fr., fimbriata (Pers.) Fr., *D.*

Kneiffia setigera Fr.

Stereum hirsutum (Willd.) Fr., purpureum (Pers.) Fr., spadiceum (Pers.) Fr., *S.*, *T.*, sanguinolentum (A. & S.) Fr., *B.*, rugosum (Pers.) Fr.

Hymenochaete rubiginosa (Dicks.) Lév., *B.*, *D.*, tabacina (Sow.) Lév., *S.*, fuliginosa (Pers.) Lév., *D.*, *T.*, corrugata (Fr.) Lév.

Corticium porosum B. & C., *T.*, lacteum Fr. *D.*, *T.*, arachnoideum Berk., *B.*, *T.*, laeve (Pers.) Fr., *T.*, lactescens Berk., calceum (Pers.) Fr., *T.*, Sambuci (Pers.) Fr., *D.*

Peniophora quercina (Pers.) Cke., gigantea (Fr.) Massee, *T.*, cinerea (Pers.) Cke., velutina (DC.) Cke., *T.*, hydnoides Cke. & Mass., incarnata (Pers.) Massee, *T.*

Coniophora arida (Fr.) Cke., *B.*

Cyphella villosa (Pers.) Karst., *D.*

Clavaria umbrinella Sacc., *D.*

Pistillaria tenuipes (B. & Br.) Massee, *T.*, puberula Berk., *T.*

Auricularia mesenterica (Dicks.) Fr., *D.*

Hirneola Auricula-Judae (Linn.) Fr., *D.*, *T.*

Exidia glandulosa (Bull.) Fr., *S.*, *T.*, albida (Huds.) Bref., *B.*, *S.*, *T.*

Phaeotremella pseudofoliacea Rea. *S.*
Femsjonia luteo-alba Fr., *B.*, *D.*, *S.*, *T.*
Tremella mesenterica (Retz.) Fr., *T.*, lutescens (Pers.) Fr., *S.*
Dacryomyces deliquescens (Bull.) Duby, *S.*, stillatus Nees, *D.*, *T.*
Calocera viscosa (Pers.) Fr., *S.*, cornea (Batsch) Fr., *T.*, stricta Fr., *T.*
Ithyphallus impudicus (Linn.) Fisch., *T.*
Mutinus caninus (Huds.) Fr., *B.*
Sphaerobolus stellatus (Tode) Pers., *T.*
Cyathus striatus (Huds.) Pers., *S.*
Bovista plumbea, Pers., *D.*, nigrescens Pers., *B.*
Lycoperdon pyriforme (Schaeff.) Pers., umbrinum Pers., *S.*
Scleroderma vulgare Hornem., *D.*, verrucosum (Bull.) Pers. *S.*, *T.*
Puccinia violae (Schum.), *S.*, menthae Pers., *D.*, *S.*, caricis (Schum.) Rebent, *D.*, *S.*, suaveolens Pers., *S.*, iridis (DC.) Wint., *S.*, pruni Pers., *S.*, malvacearum Mont., *D.*, circaeae Pers., *T.*, glechomatis DC., *T.*
Phragmidium violaceum (Schulz.) Wint., rubi (Pers.) Wint., *S.*, albidum (Kühn) Ludw. (= Chrysomyxa), *B.*, *D.*, *S.*
Melampsora hypericorum (DC.) Schröt, *S.*
Melampsoridium farinosa (Pers.) Schröt., *S.*, betulinum (Pers.) Kleb., *D.*
Coleosporium tussilaginis (Pers.) Klebahn, *D.*, sonchi (Pers.) Lév., *T.*
Sphacelotheca hydropiperis (Schum.) de Bary, *T.*
Sphaerotheca pannosa (Wallr.), Lév., *T.*, Castagnei Lév.
Podosphaera tridactyla (Wallr.) de Bary, *D.*, *on Prunus spinosa.*
Erysiphe graminis DC., Martii Lév., *D.*, *on Arctium*, tortilis (Wallr.) Fr., *S.*, *on Cornus sanguinea.*
Microsphaera Euonymi (DC.) Sacc., *S.*, *on Euonymus europaeus*, alni (DC.) Wint., *D.*
Uncinula aceris (DC.) Sacc., *S.*
Phyllactinia suffulta (Rebent) Sacc., *S.*, *on Fraxinus*, *Crataegus*, and *Pyrus aucuparia.*
Nectria cinnabarina (Tode) Fr., *T.*, coccinea (Pers.) Fr., *T.*, aquifolii (Fr.) Berk., *T.*, episphaeria (Tode) Fr., *D.*, *T.*
Hypomyces aurantius (Pers.) Tul., *T.*
Hypocrea rufa (Pers.) Fr., *S.*, lactea Fr., *S.*
Cordyceps militaris (Linn.) Link., *B.*, *D.*
Leptospora ovina (Pers.) Fckl., *B.*, *T.*, spermoides (Hoffm.) Fckl., *D.*
Rosellinia aquila (Fr.) de Not., *D.*
Bombardia fasciculata Fr., *T.*
Bertia moriformis (Tode) de Not., *S.*
Diatrypella quercina (Pers.) Nitsch., favacea (Fr.) Nitsch., *T.*
Diatrype stigma (Hoffm.) de Not, *B.*, *D.*, *T.*
Hypoxylon multiforme Fr., *T.*, rubiginosum (Pers.) Fr., *B.*, fuscum (Pers.) Fr., *S.*, *T.*, coccineum Bull., *S.*

Daldinia concentrica (Bolt.) Ces. & de Not., *D.*
Ustulina vulgaris Tul., *D.*, *T.*
Xylaria hypoxylon (Linn.) Grev.
Phyllachora graminis (Pers.) Fckl., *B.*
Dothidella betulina (Fr.) Sacc., *S.*, ulmi (Dur.) Wint., *S.*
Rhopographus pteridis (Sow.) Wint.
Leotia acicularis (Bull.) Fr., *T.*
Otidea aurantia (Pers.) Massee., *T.*, onotica (Pers.) Fckl., *T.*
Humaria granulata (Bull.) Quél., *D.*
Dasyscypha calycina (Schum.) Fckl., *D.*, *S.*, virginea (Batsch) Fckl.
Lachnea scutellata (Linn.) Gill., *T.*
Tapezia eriobasis (Berk.) Phil., *B.*, *T.*
Chlorosplenium aeruginosum (Oed.) de Not., *D.*
Ciboria ochroleuca (Bolt.) Massee, *T.*, pseudotuberosa (Rehm) Sacc., *T.*
Helotium citrinum (Hedw.) Fr., *D.*, aureum (Pers.) Mass., *T.*, virgultorum (Vahl.) Karst. var. fructigenum (Bull.) Rehm, *T.*, alniellum (Nyl.) Karst.
Mollisia cinerea (Batsch) Karst., melaleuca (Fr.) Sacc., *T.*
Ascobolus furfuraceus (Pers.) Fr., *D.*, viridulus Phil. & Plow., *D.*
Coryne sarcoides (Jacq.) Tul., urnalis (Nyl.) Sacc., *D.*, *T.*
Corynella glabrovirens Boud., *B.*
Calloria fusarioides (Berk.) Fckl., *S.*
Orbilia leucostigma Fr. and var. xanthostigma (Fr.) Rehm.
Bulgaria polymorpha (Oeder) Wettstein, *D.*
Heterosphaeria patella (Tode) Grev., *S.*, *T.*
Propolis faginea (Schrad.) Karst., *S.*
Rhytisma acerinum (Pers.) Fr., salicinum (Pers.) Fr., *T.*
Trochila ilicis (Fr.) Crouan., *D.*
Phacidium multivalve (DC.) Kze. & Schmidt. *D.*
Dichaena quercina (Pers.) Fr., *D.*
Hysterium angustatum (A. & S.) Nisk., *B.*
Phytophthora infestans (Mont.) de Bary, *T.*
Septoria rosae Desm., *S.*, rubi Westend., *S.*, hederae Desm., *D.*, primulae Bucknall, *S.*, *T.*, Violae Westend., *S.*
Monilia fructigena (Pers.) Fr., *S.*
Oidium alphitoides Griff. & Maul., *D.*, *S.*, *T.*, Euonymi-Japonicae (Arcang.) Sacc., *D.*
Botryosporium pulchrum Cda., *T.*
Sepedonium chrysospermum Nees.
Acrostalagmus cinnabarinus Cda.
Ramularia calcea Desm., *T.*
Zygodesmus fuscus Cda.
Stilbella erythrocephala (Ditm.) Lindau, *B.*, *D.*
Tilachlidium tomentosa (Schrad.) Lindau, *B.*
Isaria farinosa (Dicks.) Fr., *B.*
Aegerita candida (Pers.) Grev., *D.*

LIST OF MYCETOZOA.

By Miss Gulielma Lister, F.L.S.

Ceratiomyxa fruticulosa (Muell.) Macbr. (Syn. *C. mucida* Schroet.).
Badhamia utricularis (Bull.) Berk.—in plasmodium only.
Physarum nutans Pers.
P. viride (Bull.) Pers.
P. psittacinum Ditm.
Fuligo septica Gmel.
Craterium minutum (Leers) Fr. (Syn. *C. pedunculatum* Trent.).
C. leucocephalum (Pers.) Ditm.
Didymium nigripes (Link) Fr.
D. squamulosum (Alb. & Schw.) Fr. (Syn. *D. effusum* Link).
Stemonitis fusca Roth.
Comatricha nigra (Pers.) Schroet. (Syn. *C. obtusata* Preuss).
Cribraria aurantiaca Schrad.
Dictydium cancellatum (Batsch) Macbr. (Syn. *D. umbilicatum* Schrad.).
Enteridium olivaceum Ehrenb. var. *liceoides* Lister. First record of the species in Somerset.
Reticularia Lycoperdon Bull.
Lycogala epidendrum (Linn.) Fr. (Syn. *L. miniatum* Pers.).
Trichia affinis de Bary.
T. persimilis Karst.
T. varia Pers.
T. decipiens (Pers.) Macbr. (Syn. *T. fallax* Pers.).
Arcyria cinerea (Bull.) Pers. (Syn. *A. albida* Pers.).
A. pomiformis (Leers.) Rost.
A. incarnata Pers.
A. denudata (Linn.) Sheldon (Syn. *A. punicea* Pers.).
A. nutans (Bull.) Grev. (Syn. *A. flava* Pers.).
Perichaena corticalis (Batsch) Rost. (Syn. *P. populina* Fr.).

PRESIDENTIAL ADDRESS.

By Professor E. S. Salmon, F.L.S., Hon. F.R.H.S.

ECONOMIC MYCOLOGY AND SOME OF ITS PROBLEMS.

Economic Mycology—or the study of Fungous Diseases of cultivated plants—is a branch of Mycology which has only very recently received any serious attention in this country. The economic importance of a thorough and systematic control of the fungous diseases of our cultivated plants—carried out both by the State and by the individual grower—is indeed hardly yet recognised in this country, whereas in the United States, and also in our Colonies, this fact has been realised and energetic action taken, for the past twenty years. It is satisfactory to be able to record that at last steps are being taken in this country in the same direction. The first recognition by our Government of the importance of controlling fungous diseases was shown in 1907, in which year the "Destructive Insects and Pests Act" became law. Under this Act powers are given to our Board of Agriculture to deal with insect and fungous diseases of *plants* by measures similar to those employed by them against such contagious diseases of *animals* as foot-and-mouth disease, swine fever, glanders, &c. There are now some half-dozen special Inspectors attached to the Board of Agriculture, and an increasing number of similar Inspectors employed by County Councils, who travel about the country making investigations and collecting statistics with regard to certain scheduled fungous diseases of plants. The *educational* effect of this Act during the four years since it has been in force has already been considerable; both on farmers and fruit growers and also on the Board of Agriculture itself. When the scientific side of the Board of Agriculture has been strengthened, so that this Act is administered with more scientific judgment, this recent piece of legislation will prove of direct *practical* importance. The chief fungous disease which has been proceeded against under the Act is the American Gooseberry-mildew (*Sphaerotheca mors-uvae*). Orders have been issued prohibiting the importation of all gooseberry bushes from foreign countries, and putting in force such measures as the compulsory pruning in winter of affected bushes, the prohibition of the sale of diseased stock, or its removal except under license. In several counties—though not, it can be said to its credit, in Kent—a few growers have failed to carry out the prescribed measures, and have been summoned before magistrates and fined. Although perhaps it

may seem somewhat brutal to view it in such a light, a public fine is an excellent educational instrument. When such a thing happens, and is duly reported in the press, that important person, "the man in the street," hears of plant diseases and the possibility of combating them, and an enlightened public opinion is gradually created. That no protests against the infliction of these fines have been made by growers generally, shows perhaps that as a body they have come to recognise the economic necessity for compulsory measures for the protection of their crops from new contagious diseases.

It is within the last five years or so, too, that serious attention has been given by the individual grower to the question of combating fungous diseases. It is true that for many years past in certain districts potatoes have been sprayed against potato "blight," but it is only quite recently that this practice is becoming widespread, and that spraying against fungous diseases gen lly on a commercial scale is being adopted by the grower of fru ad vegetables in county after county. The fruit grower is just realising—to take two instances—that the very existence of commercial apple-growing depends on his learning how to deal successfully with two fungous diseases—Apple "Scab" *(Venturia pomi)* and Apple "Canker" *(Nectria ditissima)*, and that he will lose his plantation of "Victoria" plums, tree by tree, unless he takes steps to prevent the "Silver-leaf" fungus *(Stereum purpureum)* from fruiting and spreading.

Before a scientific audience such as this I do not intend to dwell on the purely economic side of the subject: such matters as statistics which show the heavy losses caused annually by fungous diseases, or points such as the various methods of spraying, and the results obtainable,—or whether it is equitable or not to pay compensation out of public funds for crops compulsorily destroyed,—all such points which are concerned with the commercial side of the subject, while of vital importance to the practical man, must necessarily be comparatively uninteresting to the scientist.

The problems to which I wish to refer on this occasion are purely scientific ones, and among them are some to whose elucidation members of our Society, as well as those of local Natural History Societies, could, I think, bring assistance.

One important problem may be stated thus:—what is the *economic* importance of that specialisation of parasitism now proved to exist in many fungi? We find this specialisation carried to a high degree in the "powdery mildews" *(Erysiphaceae)* and in the "rusts" *(Uredineae)*. I will select a few examples from the first group to show the nature of the problem with which we are confronted. If we take a species of the *Erysiphaceae* which occurs on a number of host-species, it can be shown by inoculation experiments that any one form on a

given host-species *a* possesses different powers of infection from the form on host-species *b*. Such forms of a species are identical *morphologically*, but differ *physiologically* or *biologically*, as is shown by their different powers of infection. These forms are termed "biologic forms." Now with this discovery it follows that before the real nature of any immunity to disease shown by a plant can be determined, the extent of the specialisation of parasitism reached by the parasitic fungus must be ascertained. Let us take an actual case to illustrate this point. I have shown* by repeated inoculation-experiments that spores of the forms of *Erysiphe Graminis* on *Bromus commutatus*, *B. interruptus*, *B. hordeaceus*, *B. velutinus*, and *B. secalinus* when sown on the leaves of *B. racemosus* are totally unable to cause any infection. Thus we might have plants of *B. racemosus* surrounded by a belt of mildewed plants belonging to the five species of *Bromus* mentioned above remaining completely "immune," although spores of *E. Graminis* were blown on to its leaves night and day. An observer of this fact might naturally infer that *B. racemosus* was "immune" to the attacks of the morphological species *E. Graminis*, but he would be wrong. We find that *B. racemosus* is in nature often virulently attacked, but only by its own specialised "biologic form." If then to that belt of mildewed grasses surrounding the plants of *B. racemosus* which remained "immune" were added one mildewed plant of *B. racemosus*, the "immunity" would at once disappear. It is probable that such cases of partial resistance, i.e., resistance to most, or all but one, of the numerous specialised forms of a fungus are not uncommon. Such cases appear inexplicable—or are falsely explained—until the specialisation of parasitism reached by the fungus is investigated.

Now the problem is: what is the exact *economic* importance of this specialisation of parasitism? The "biologic form" of a parasitic fungus has its limited powers of infection as sharply defined in all the stages of its life-history (conidial and ascigerous, in the case of the *Erysiphaceae*) and must obviously therefore be considered an important "entity" for the economic mycologist. For if a particular host-species of a morphological species of fungus remains *under all conditions* "immune" to all but its own "biologic form," then the combating of certain plant-diseases will be simplified. Take the case of the Hop-mildew (*Sphaerotheca Humuli*), which in many years is the cause of very heavy losses to the hop-grower. The morphological species *S. Humuli* occurs on a large number of wild plants, many of them weeds likely to occur in the neighbourhood of hop-gardens, e.g., *Potentilla reptans*, *Spiraea Ulmaria*,

* "On *Erysiphe Graminis* DC., and its adaptive parasitism within the genus *Bromus* (Annal. myc., II. (1904)).

Alchemilla arvensis, Epilobium spp. We know now* that *S. Humuli* consists of a number of "biologic forms," each confined to one or more species of a particular genus of host-plants. If it is a fact that none of these "biologic forms" can *under any circumstances* infect the hop, the removal or spraying of weeds affected with "hop-mildew" is totally unnecessary.

Certain facts are known, however, which show that the "immunity" of some host-species may be affected in various ways. Thus, to take an actual instance, the spores of the "biologic form" of *Erysiphe Graminis* found in nature on *Bromus racemosus* are unable to infect *B. commutatus;* they can, however, infect *B. hordeaceus.* Now the spores of the "biologic form" found in nature on *B. hordeaceus* are able to infect *B. commutatus.* Actual experiment has proved† that if spores are taken from *B. racemosus* and sown on *B. hordeaceus*, and the spores of the resulting generation sown on *B. commutatus*, infection readily results.

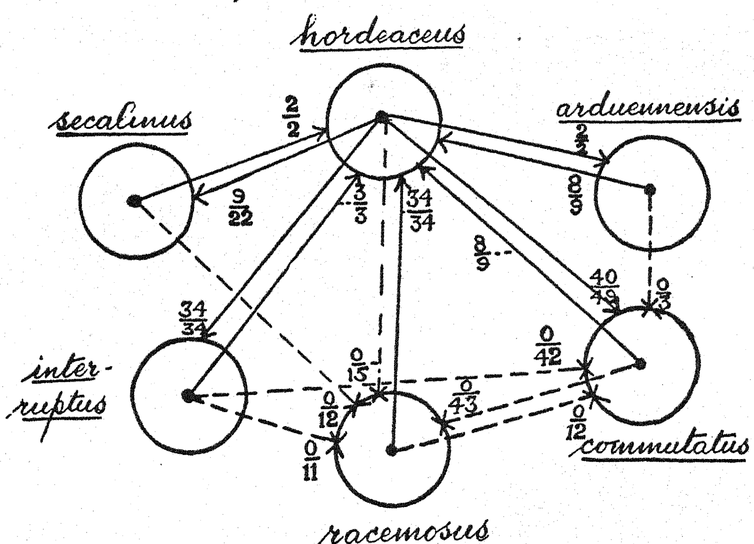


Diagram illustrating the position of *B.* "*hordeaceus*" as a "bridging species." *B.* "*hordeaceus*" is infected by the forms of *E. Graminis* on *B. racemosus*, *B. interruptus*, and *B. arduennensis*, and the fungus occurring on *B.* "*hordeaceus*" is able to infect *B. commutatus.* (The number of inoculations made, and the results obtained are expressed in the form of a fraction, in which the numerator indicates the number of times in which infection resulted,

* *Salmon, E. S.*, in The New Phytologist, vol. III. (1904); *Idem*, in Journ. Agric. Science, vol. II. (1907).

† *Salmon, E. S.*, Recent Researches on the Specialisation of Parasitism in the *Erysiphaceae* (The New Phytologist, vol. III. (1904) where a bibliography of the subject is given.

and the denominator the number of leaves inoculated.) Assuming that the fungus produced on *B.* "*hordeaceus*" by inoculation with conidia from *B. racemosus*, *B. interruptus*, and *B. arduennensis* is able to infect *B. commutatus*, *B.* "*hordeaceus*" will serve as a "bridging species" enabling the forms of the fungus on these three host-plants to pass on to *B. commutatus*, a species which they are unable to infect directly. That such is actually the case with regard to *B. racemosus* and *B. commutatus* has been proved by experiments—see Diagram below.

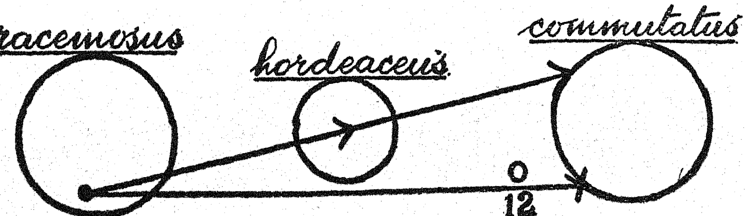


Diagram illustrating the result of experiments. *B.* "*hordeaceus*" is here shown to serve as a "bridging species," affording the fungus on B. *racemosus* a passage to *B. commutatus*, a species which this fungus is unable to infect directly.

So that *B. hordeaceus* acts as a "bridge"—or "bridging species" as I have termed it—enabling the form of the fungus on *B. racemosus* to pass on to *B. commutatus*—a species safe against its direct attacks. The "immunity of *B. commutatus* would remain absolute if surrounded by a belt of mildewed plants of *B. racemosus*, but if a perfectly healthy plant of *B. hordeaceus* were placed among them, *B. commutatus* would soon become infected. The facts presented graphically in the first diagram given above render it almost certain that the existence of such a species as *B. hordeaceus* will considerably affect the "immunity" of other host-species. It seems possible that the intervention of "bridging species" accounts for the fact that we have powdery mildews in the conidial stage present year after year on species of plants which never show the ascigerous stage of these fungi, e.g., the common garden species of *Myosotis* become mildewed each season, although so far as is known no perithecia are formed on this host-genus.

Another direction in which "biologic forms" may acquire wider powers of infection lies possibly in the lessened "vitality" of the cells of a host-plant. I have shown by experiments† that if the "vitality" of a leaf of a host-plant is affected by subjecting it to heat, or to anaesthetisation, or if the leaf is mechanically injured by pressure or by having pieces cut out of it, or eaten out of it by slugs, &c., then that leaf, or certain of its cells, are able to

† *Salmon, E. S.*; Cultural Experiments with "biologic forms" of the *Erysiphaceae* (Phil. Trans. Royal Society, vol. 197 (1904); *Idem*, in "Annals of Botany" vol. 19 (1905).

be infected by "biologic forms" which under normal circumstances are unable to do so. To what extent, if at all, does this happen in nature? Do plants whose leaves are injured in any way—and it is rare to find a fully-grown leaf that does not show some minute injury—become infected by "strange" "biologic forms"? Does, for example, the practice of rolling wheat, whereby many of the leaves are bruised, render this plant liable to the attacks of the "biologic forms" on barley and on oats, which we know are unable to infect uninjured leaves of wheat? A case came under my observation* where, apparently, plants of *Hordeum secalinum* became susceptible only when the health of the plants was impaired by unfavourable cultural conditions. In other cases there has been some evidence that susceptibility has been induced by the attacks of "green fly" *(Aphis)* on a plant. In the case of the hop, and of a number of other cultivated and also wild plants, it is noteworthy how frequently an attack of powdery mildew is coincident with an attack of "green fly."

In leaving the subject of specialisation of parasitism, it must be pointed out that with regard to the majority of diseases caused by parasitic fungi—many of them of great economic importance—we are still in ignorance as to whether this specialisation occurs or not. Until this knowledge is obtained, the economic mycologist is at a loss to answer many questions put to him by the practical grower. For example, the fungus *Nectria ditissima*, which is the cause of the "canker" disease of the apple—a disease which has ruined many a plantation and indeed put many varieties of apples out of cultivation—occurs also on the pear and on a large number of our wild trees, such as the ash, beech, oak, hornbeam, and others. Whether this fungus has become specialised to its different host species we do not know. An instance occurred recently where a fruit grower planted up a field with apple-trees, and then found in the hedges surrounding this field ash-trees badly infested with *Nectria ditissima*. In our present state of knowledge it is impossible to say what danger to the health of the apple-trees was incurred by the proximity of the "cankered" ash-trees.†

Another problem which confronts the economic mycologist is this: what degree of importance, from the economic point of view, is to be attributed to the *saprophytic* stage in the life-history of any fungus causing a plant disease. As an instance typical of this class of diseases, I would cite the Apple and Pear

* *Salmon, E. S.*; Cultural Experiments with the Barley Mildew (Annal. myc. vol. 2 (1904).

† Goethe records (Landwirt. Jahrb., IX (1880)) that ascospores of *N. ditissima* obtained from the Beech infected the Apple, and conversely; also that conidia of this fungus taken from the Apple infected the Beech and *Acer Pseudo-platanus*, but not the Horse-Chestnut nor *Ulmus montana*.

"Scab" *(Venturia pomi* and *V. pirina),* which ruins tons of apples and pears every season in this country. In the life-cycle of these species the conidial stage is *parasitic* on the fruit, leaves and young wood; the ascigerous stage develops as a *saprophyte* in the dead, fallen leaves. This saprophytic stage has been recorded from the United States, and from the Continent, where it is said to be not uncommon, but it has not, as yet, been recorded from this country, although very probably it occurs here. In such a life-history as this—which obtains in a fairly large class of plant diseases—what importance, in connection with the annual outbreaks of the disease, is to be attributed to this saprophytic stage? I have shown* that at any rate in mild seasons in this country the parasitic, conidial stage winters over on the young shoots of the apple or pear, but have we as well centres of infection from these fungi existing as saprophytes? Another case is that of the common and often destructive disease of the Gooseberry known as "Die-back" or "Collar-rot," caused by *Botrytis cinerea,* which is ubiquitous as a saprophyte. To what extent *parasitic* outbreaks of this disease proceed from *saprophytic* centres of infection is at present quite unknown.

Another very important question is: what are the conditions under which some saprophytic species of fungi become parasites. Exact knowledge on this point is much wanted at the present time with regard to the most destructive disease known as "Silver-leaf"—which is laying waste whole plantations of plums and, indeed, beginning to threaten the very existence of one of the best varieties of cultivated plums, viz., the "Victoria." Through the work of Prof. J. Percival,† and of Mr. Spencer Pickering,‡ we know that this disease is caused by the fungus *Stereum purpureum.* Now *S. purpureum* is accounted a very common saprophyte, occurring on the trunks and branches of dead trees, particularly on dead firs and on birch stumps. Under what conditions does this fungus become parasitic—does it need merely the proximity of a Plum tree to make it change its habits? Is this fungus as a rule entirely saprophytic, or has it previously killed those trees on whose dead wood its fructifications so commonly occur? Or are there two strains, or races, of *S. purpureum*—a saprophytic and a parasitic one?§ A careful

* Journ. S. E. Agric. Coll., vol. 15 (1896).

† *J. Percival,* "Silver-leaf Disease" (Journ. Linn. Soc. vol. 35 (1902).

‡ *S. U. Pickering* (Woburn Experimental Fruit Farm, Sixth and Twelfth Reports 1906 & 1910).

§ Grossenbacher and Duggar have recently stated (New York Agric. Exper. Station, Bull. 18 (1911)) that they consider, from the results obtained in comparative inoculation experiments, that *Botryosphaeria Ribis* (which kills the shoots of Currants in the United States) is made up of two *physiologically distinct* fungi within the morphological species. "Both forms are present on the bushes of a blighted plantation, yet only one of the forms is an active parasite."

study by field mycologists of the prevalence and habits of *S. purpureum* in different districts would be of the greatest help to the economic mycologist.

Another interesting problem—the solution of which would probably throw considerable light on the nature of the parasitism of certain fungi—may be stated thus: What are the conditions under which a parasitic fungus attacks a new host-species? Two striking instances among the *Erysiphaceae* have recently occurred in this country. The European Gooseberry-mildew (*Microsphaera Grossulariae*), which has been known in this country, probably for over a hundred years, as a common and comparatively harmless pest of the cultivated Gooseberry, was noticed, four years ago, in one of the fruit-plantations at Wye College, Kent, on a number of Red Currant bushes. In the following years I observed it again on the same Red Currants, and also on Red Currants on three different fruit-farms in other parts of Kent. Now the European Gooseberry-mildew has never before been recorded in any country as attacking the Red Currant. It is scarcely conceivable that had it done so, its occurrence could have been passed over, as it is very conspicuous, and these "powdery mildews" have always been collected assiduously. It must be noted, too, that this fungus has had the opportunity—as regards the proximity of this new host-species—for a very long time, since Red Currants and Gooseberries are commonly grown side by side in fruit plantations and gardens, yet until lately it has not, apparently, been able to attack the Red Currant. Does this indicate some change on the side of the fungus; or is it that in the course of the cultivation of the Red Currant new varieties have been produced which are susceptible to this mildew; or is it, possibly, that the older varieties of the Red Currant have, through continued cultivation, arrived at a state in which they are no longer immune? The second case is that of the American Gooseberry-mildew (*Sphaerotheca mors-uvae*) attacking the Black Currant. In North America, the home of this mildew, it attacks, besides the native and introduced species of Gooseberries, the Red Currant, but no case has ever been recorded of its attacking the Black Currant. On the introduction of the mildew into Europe, a little before 1900, it began almost immediately to attack the Black Currant; I have seen it on this host in several localities in Kent, where apparently it had spread from badly-infested Gooseberry-bushes, and it has been found also in several places on the Continent. A case somewhat related to the last is that of the "downy mildew," *Plasmopara viticola*, and certain species of *Vitis*. When this mildew invaded Europe, certain American species of *Vitis*, which in their native country suffer but little from the attacks of this mildew, proved very susceptible when

cultivated in Europe. What is, apparently, another case of a new host-plant being attacked has lately occurred with consequences likely to be of the greatest economic importance. One of the "scheduled" plant diseases now being proceeded against —or at any rate watched—in this country under the new Act is the "wart disease" or "black scab" of the potato,—a disease which is capable of completely destroying the potato crop in badly infected soil. This disease is due to the fungus *Synchytrium endobioticum*, which was first described a few years ago on the potato in Hungary. It seems probable, however, that this parasite has existed previously somewhere on the Continent, on some native plant as yet undiscovered, and has recently passed from this plant to the potato as a new host.

One other case may be mentioned where we find, apparently, a fungus learning to attack—so to speak—new host species. *Stereum purpureum*—the Silver-leaf fungus, referred to above, has it seems, according to the testimony of growers, during the last ten years or so extended its attacks to Apple and Cherry trees. One particular variety of apple, "Lord Suffield," is now attacked by "Silver-leaf" with increasing frequency.

I should like to mention also a set of problems connected with the methods of combating fungous diseases. The methods of combating disease can be divided into three, (1) external treatment of the plant; (2) internal treatment of the plant; (3) selection or breeding for resistance to disease.

In the first method the plant is sprayed with a chemical substance, or combination of chemical substances, which either directly kills the fungus—e.g., sulphur and copper sulphate—when it may be called a *direct fungicide;* or which protects the parts sprayed against external infection, e.g., Bordeaux mixtures, which are *protective fungicides.* In each case we require exact knowledge on *(a)* the chemical nature of the fungicide, and *(b)* the effect of the fungicide on the vital activities of the fungus and (if any) on those of the host-plant. It must be admitted that our knowledge here is still very incomplete. Although sulphur and sulphides of potassium have been in common practical use for a very long time, we are still in almost entire ignorance as to their action on the fungus. In the case of Bordeaux mixture, discovered about 1875, it was not until 1907 when Mr. Spencer Pickering carried out his researches,* that its chemistry was elucidated. Bordeaux mixture is the best and the most widely-used of all fungicides, yet its exact fungicidal action is still a matter of dispute. According to what may be termed the *chemical* explanation, put forward by Mr. Spencer Pickering, it is due to copper sulphate liberated from insoluble

* *S. U. Pickering;* The chemistry of Bordeaux mixture (Woburn Experimental Fruit Farm, Eighth Report (1908).

basic sulphates of copper by atmospheric carbon dioxide; according to the *biological* explanation, advanced by Swingle, Clark, Schander and others, and supported by the important recently-published work of Messrs. Barker and Gimingham,† the fungus itself acts on the insoluble copper compound in such a way as to poison itself. Many important practical points in the treatment of plant diseases stand to be affected by any advance in our scientific knowledge on the present subject.

If the biological explanation of the fungicidal action of Bordeaux mixture is correct, then we have scientific grounds for emphasising the importance of two practical points in the making and application of Bordeaux mixture. Messrs. Barker and Gimingham believe that the fungus acts on the insoluble copper compound only when there is actual contact between the fungus and the particles of the insoluble copper compound. Therefore in making Bordeaux mixture, that practical method should be followed by which the copper precipitate is obtained in as finely divided a state as possible; and, secondly, it follows that Bordeaux mixture should be applied in as finely divided a spray as possible, so as to deposit very minute drops uniformly over the surface of the sprayed part.

Another very important problem concerns the nature of the injuries which occasionally occur on plants after they have been sprayed. A form of injury known as "Bordeaux injury," which follows the use of Bordeaux mixture on some varieties of fruit-trees, is often so severe that it has lead to the abandonment of the use of this valuable fungicide on the varieties in question. In connection with this problem—which is continually being brought to his notice by the practical grower—the economic mycologist has to study many non-mycological matters such as the different degrees of susceptibility to this injury shown by the various "varieties" of cultivated plants; the effect of different meteorological conditions on foliage and fruit before and after spraying;—and so forth. Experiments carried out at Wye College during the past season have shown that under certain weather conditions gooseberry bushes are almost completely defoliated when sprayed with a certain lime-sulphur spray, which under other weather conditions is harmless to them. Further, susceptibility to injury from this spray varies very greatly according to the variety of gooseberry. It has also been shown* that a particular variety of apple which is very susceptible to "Bordeaux injury" may be safely sprayed with a lime-sulphur spray.

† *B. T. P. Barker* and *C. T. Gimingham*; The fungicidal action of Bordeaux mixture (Journ. Agric. Science, vol. 4 (1911)); *C. T. Gimingham*; The action of carbon dioxide on Bordeaux mixtures (l.c.).

* Journ. S. E. Agric. Coll., vol. 19 (1910).

Also, such practical points as the following must be considered to lie within the field of work of the economic mycologist; the selection of different types of spraying machines and nozzles for use with different sprays and for different crops; and the testing of the comparative efficiency and cost of hand-, petrol-, compressed air- and steam-power for spraying. He should be acquainted, too, with the most economical use of labour in the work of spraying, and also of the best systems from his special point of view of the planting up, and subsequent management, of the orchard and plantation. In parts of Kent the practice of spraying has already become so firmly established that the most progressive fruit-growers are now laying out from the start their fruit plantations in such a way that spraying can be most efficiently and economically carried out.

The second method of combating fungous diseases is by injecting into the plant, or by making its roots take up, some substance which absorbed into the tissues will confer immunity against the disease. This method must be regarded at present more as a theoretical way of dealing with diseases of plants than a practical one. In certain directions, however, some success has been reported. Marchal, in 1902, stated* that lettuces are made resistant to the attacks of the lettuce mildew *(Bremia Lactucae)*—a disease which often causes heavy losses to this crop when raised on the French system of gardening—when seedlings are grown in a nutrient solution to which copper sulphate has been added in the proportion of 3 or 4 parts to 10.000 parts of water. Massee soon afterwards stated† that cucumbers grown in soil watered with a solution of copper sulphate become "immunised" against the "spot" disease *(Cercospora Melonis)*. Mr. A. D. Hall carried out experiments‡ to test the latter statement, and these showed that it is very questionable if such a result can be obtained. I may refer here to my own experiments § which showed very definitely that seedlings of cereals cannot be made resistant to mildew *(Erysiphe Graminis)* by making them absorb copper. Seedlings of wheat, barley and oat were grown in a series of cultures, and various amounts of copper sulphate added to the nutrient solution; in every case—even in those where the seedling plants had taken up so much copper that its leaves were stunted in growth and of an abnormal, dark green colour—infection resulted on the leaves of the treated plants as readily as on those of the untreated "control" plants. Cases have been recorded of success following the in-

* *E. Marchal;* De l'immunisation de la Laitue contre le Meunier (Comptes Rendus, 135 (1902))

† *G. Massee;* in Journ. Roy. Hort. Soc., vol. 28 (1903).

‡ *A. D. Hall;* in Journ. Board Agric., vol. 12 (1905).

§ *E. S. Salmon;* in Annal. myc. vol. 2 (1904).

jection of iron sulphate into the stems of plum-trees affected with "Silver-leaf," but these do not rest on scientific testimony.

The third method—that of obtaining plants resistant to disease by selection or by breeding—is one which is now attracting more and more scientific attention. For dealing with certain classes of diseases—such as the Rusts *(Uredineae)* or the class known as "soil diseases"' *(Fusarium*-"wilts,' *Oospora*- and *Synchytrium*- "scabs," &c.)—this method offers the only solution. Important practical results have already been obtained in this field of work. One of the earliest successes was obtained in the United States, in connection with the "wilt-" disease of cotton *(Fusarium niveum).* Dr. Orton, one of the mycologists on the scientific staff of the United States Department of Agriculture, found that in fields of cotton which were badly diseased one or two plants here and there resisted the disease and came to maturity. Seed was collected from these plants, and sown on land very subject to the disease; seed was collected from those seedlings which again proved resistant, and the operation repeated. At the end of four years plants were obtained of good cropping powers, with good quality of fibre, and with marked powers of resistance to disease. The seed of such plants was distributed by the Department of Agriculture to cotton-growers, and it was then found by general experience that these seedlings survived and produced a good crop in soils where the ordinary strains of cotton were a complete failure. In this case the practical grower quickly realised the importance of selecting for disease-resistance, and is still carrying on the work. In another case, also in the United States, "cross-"breeding between cultivated varieties of the Melon and a wild species of non-edible Citron has been successfully employed. By this means a good, edible Melon has been obtained which is resistant to a most destructive *Fusarium*-disease, very similar to the wilt-disease of cotton. In England, through the patient work of Prof. Biffen at Cambridge, wheats of high quality and immune to "rust" *(Puccinia glumarum)* have recently been produced. In this work a "rust-" resistant strain of wheat of low quality was "crossed" with one of high quality but very susceptible to "rust." The resulting "hybrid" plants all proved to be very susceptible to the disease, but these plants when self-fertilised gave seed which produced many plants immune to this "rust." Further, Prof. Biffen in his work has established the most important fact* that this susceptibility or resistance to disease behaves as a unit character, its inheritance following the now well-known Mendel's "law." In later work by Dr. Salaman, similar results have been obtained† with "hybrids" of

* *R. H. Biffen;* in Journ. Agric. Sci., vol. 2. (1907).
† *R. N. Salaman;* in Journ. of Genetics, vol. 1 (1910).

the potato as regards their resistance to the potato "blight" *(Phytophthora infestans).* It is impossible to over-estimate the economic importance of the *data* which have recently been obtained as to the inheritance of disease resistance.

All facts noted in the field that bear on the subject of disease-resistance should be carefully stored by the economic mycologist. Among the "varieties" of nearly all our cultivated plants some stand out as possessing powers of resistance to disease, or show at least what has been lately termed in America "disease endurance." Certain very suggestive facts in this connection may be noted among our cultivated varieties of apples. The "canker" disease *(Nectria ditissima)* has practically stamped out the commercial cultivation of a number of excellent English apples, e.g., the "Wellington"; and has made that magnificent apple Cox's Orange Pippin unprofitable from the commercial point of view. Now one very strong-growing variety of apple, "Bramley's Seedling" by name, proves very resistant to "canker." If badly cankered trees are cut and "top-grafted" with Bramley's Seedling grafts, the "constitutional" powers possessed by this variety enable the tree to "grow out" of the disease, so to speak—any "cankers" in the stem or branches of the stock die away or heal over; while if grafts of weaker growing varieties are used on exactly similar stocks, the trees will quickly succumb to "canker"—the disease frequently causing the graft to die where it has been inserted in the stock, or through starvation caused by the "cankers" increasing on the stem or branches of the stock. By "cross-" breeding with this end in view there could very possibly be produced new varieties of apples having the highest quality and good cropping powers combined with resistance to "canker."

In the work of raising disease-resistant varieties results can only be obtained by trained scientific workers carrying out experiments of many years' duration. We require in this country many more workers in this important field of research; it is much to be hoped that at the John Innes Horticultural Research Station, recently established at Merton, Surrey, under Prof. Bateson, the breeding of disease-resistant plants will be undertaken on an extensive scale.

Finally, I would call attention to the important problem of the education of public opinion to the economic importance of combating fungous diseases. In a book recently published in the United States, by Stevens and Hall, entitled "Diseases of Economic Plants," these sentences occur: "Much can be done towards the eradication of fungous pests by the creation of a more enlightened public sentiment regarding them. . . To create a much-needed, enlightened, aggressive public opinion is

part of the duty of plant pathology." This side of the subject should certainly not be neglected in this country; the need for enlightening public opinion is considerably greater at present in England than in the United States.

The creation at our Board of Agriculture of a properly equipped Horticultural Department is a reform long overdue. There are many directions in which such a Horticultural Department could move. There is no reason why our Government should not organise great Fruit Shows as those of other countries do. At such shows important educational exhibits could be arranged and authoritative scientific advice given with regard to plant diseases. Let me give one instance where the spread of scientific information is needed urgently. At the present time the most progressive commercial apple-growers in England and Ireland are just beginning to market their best apples in non-returnable boxes, graded and packed in the most approved American and Colonial methods. These up-to-date methods are only possible where the apples have been grown free from the "scab" fungus. The presence of "scab," in an average season, on a large proportion of English apples is the chief reason which at present tends to make the bulk of our crop of apples inferior to that of the leading fruit-growing countries. The fact that in an average season apple trees require to be sprayed to keep off the "scab" fungus is one which requires to be driven home. With an energetic State Horticultural Department the present partial wastage year after year of the English apple crop due to the ravages of "scab," "canker," and "brown rot," could be enormously diminished or even stopped.

Further, illustrated articles on the common fungous diseases, with the methods of prevention, should be sent to journals widely read by the public, together with statistics, readably presented, showing the heavy annual losses due to the destruction or deterioration of cultivated plants caused by parasitic fungi. This method of popularising technical knowledge is widely used in America and in our Colonies. In connection with the cultivation of land in "small holdings," which is now being advocated, it should be pointed out that the intense cultivation of most crops demands for commercial success a sound knowledge of the best methods of combating plant-diseases. In Ireland the farmers are assisted by the State to purchase potato-sprayers and materials for making sprays; in connection with any scheme in this country for the creation of Credit Banks for the assistance of "small holders," provision should certainly be made for assisting them with loans for the purchase of spraying machinery and necessaries. Also, some information on the subject of plant diseases might be given in the rural school.

There are many other ways in which the economic importance of the present subject can be brought home to the grower and public generally, and none of these should be neglected by the State. To protect our crops against epidemics of disease caused by fungi and insects further compulsory measures will be required, and it must not be forgotten that for legislation to have its full beneficial effect it always requires to be sustained by an educated public opinion.

NOTE SUR LE PSEUDOPHACIDIUM SMITHIANUM.

Par Emile Boudier.

Lorsqu 'en 1908 je fis paraître dans le Bulletin de la Société mycologique d'Angleterre, ma notice sur le petit Discomycète découvert par Miss Lorrain Smith, et que m'avait communiqué mon bon ami Mr. Carleton Rea, je croyais avoir eu en mains des échantillons, nombreux cependant, ayant atteint leur complète évolution. Il n'en était rien d'après ce que j'ai pu reconnaître en Août de cette année, sur de très nombreux spécimens que notre Collègue Mr. Crossland a eu la bonté de m'envoyer à deux reprises différentes. L'examen de ces nouveaux exemplaires m'a permis de constater, comme l'avait déjà reconnu notre savant Collègue lui-même, que les spores de cette espèce n'étaient pas seulement continues et incolores ou peu colorées, mais qu' avec l'âge, non seulement elles acquéraient une coloration intense, poussée même à parfaite maturité, jusqu' au noir-olivâtre mais présentaient alors une cloison médiane bien visible seulement à cette époque, puisque ces spores ayant même la couleur olive foncé n'en montrent souvent pas. De plus je ferai remarquer que les paraphyses que j'avais vues primitivement simples ou seulement divisées dès la base, présentent souvent comme l'a vu aussi Mr. Crossland, des ramifications dans leur parties supérieures. Ces diverses constatations ont nécessairement dû modifier mon opinion sur le genre dans lequel cette espèce doit être rangée, et bien que quelques uns des caractères ne concordent pas suffisamment, je crois devois la faire rentrer dans le genre *Phaeangella* de Saccardo. Cette rectification nécessaire, est une preuve de plus en faveur de l'opinion que j'ai émise bien des fois, du peu de certitude qu' offre, chez les Discomycètes, l'interprétation du cloisonnement des spores. Ces organes ne présentant très souvent de cloisons dans leur intérieur que dans leur extrême évolution, peuvent amener à faire rentrer les espèces dans des genres différents, comme peut la faire aussi leur coloration tardive.

THE STUDY OF FUNGI BY LOCAL NATURAL HISTORY SOCIETIES.*

By Harold Wager, F.R.S.,
Sometime President of the British Mycological Society.

The following notes refer to the methods and possibilities of the study of Fungi by local Natural History Societies, and indicate some of the more promising lines of investigation which can be profitably taken up. It is quite true, in this as in other studies, that the path is beset with difficulties, both from the strictly utilitarian point of view and the more purely scientific one, but a more carefully organised study of this very large and important group, merits far more attention on the part of students of Natural History than has yet been accorded to it.

I think there can be no doubt that very valuable assistance can be given by Natural History Societies all over the country in the elucidation of some of the more important problems which arise. I need only refer here to the strikingly successful work of the Mycological Committee of the Yorkshire Naturalists' Union as an example of the kind of work which can be carried on by Local Societies. This Committee has been at work for more than twenty years, and during that time a number of the more important districts in Yorkshire have been systematically investigated, and in 1905 a list of some 2,626 species had been compiled, based upon no less than 16,700 records. Since then the list has been considerably increased; new records are continually being added both by individual observers and at The Annual Fungus Forays, and many new county and a few new British records are added each year. All groups of the Fungi are included in the list, but more attention has been given to the larger Fungi than to the microscopic forms in the study of which much remains to be done.

The total number of species known to occur in the British Fungus Flora is more than 5,000. This is doubtless far from being a complete list. Careful and systematic investigation would no doubt result in many more species being discovered. That of these considerably more than half have been found in

* A paper read before the Conference of Delegates at the meeting of the British Association in Portsmouth, 1911.

Yorkshire alone, is a tribute to the earnestness and zeal of this Committee.

I mention the work of this Committee more especially because it seems to me that it is by far the most definite attempt which has been made to place the study of the Fungi of a given district on a systematic basis and because it indicates so clearly what valuable work can be done by a local Committee, when carefully organised and patiently carried on for a series of years; but it must not be forgotten that work on similar lines has been carried out by other Natural History Societies, and by the British Mycological Society.

The charming coloured drawings* by Mrs. William Stebbing, Mrs. T. R. Stebbing, and Mr. Charles Crossland give some idea of the large variety and beauty of many of the forms and will, I feel sure, be a revelation to those who have paid little or no attention to this group of plants. The stereoscopic photographs* exhibited by Mr. Alfred Clarke show what possibilities are open to the student in the direction of accurate and life-like representation of the form and structure of Fungi, and of groups of Fungi in their natural surroundings and, together with the beautifully executed and artistic photographs,* which are the work of Mr. Peck, show how valuable photography may be in giving us faithful and accurate records for future reference. It is possible that before long the fascinating process of photography in colours will be called in to aid us in our studies and we shall then have not only permanent records of form and structure but also what is equally important to the student of Fungi, a permanent record of the extraordinary variation in colour of which so many species are susceptible.

The attention of Natural History Societies has been mainly directed towards recording lists of species for various localities. These have been compiled in various ways, sometimes a mere list of the names has been given; others give details of the habitats and stations in which the species are found; and sometimes the characteristics of the more important species have been added. The list published by the Yorkshire Mycological Society is arranged in accordance with the five County Divisions or vice counties of Yorkshire as employed by H. C. Watson in his Topographical Botany. It gives for each species the district, the habitat, the date when first found, and also some useful notes on the distribution of various forms, their biological characteristics, their edible or poisonous nature, and their economic importance in respect of diseases of crops and garden plants.

So far as the larger Fungi are concerned it is probable that

* Exhibited at the Conference.

we now have, as a result of the observations made by societies and individual observers in various parts of the country a fairly complete list of the species and varieties to be found in Great Britain. But there is still room for a more detailed study of the Counties and vice Counties and the preparation of a single list drawn up either on the lines of Watson's great work for flowering plants and ferns or possibly on a more natural basis of regional areas. This is one direction in which most useful work might be done. If the numerous Societies which are represented at this Conference would collaborate in a well organised survey of our Fungus Flora it seems to me that a most valuable list might be produced and material obtained for the elucidation of many important biological and ecological problems which have not yet been solved. But we want more information than is contained in Watson's Topographical Botany. If possible notes should be made for each species of its habitat, the nature of the soil, the geological formation; whether the species is parasitic or saprophytic, whether found regularly every year or sporadic only, whether it is a seasonal form only or found throughout the year, whether associated constantly with other Fungi or with definite plants or plant associations, or independent of these. Such observations might be undertaken by the various societies and sent to a Central Committee consisting of Mycologists in various departments, to be tabulated and statistically arranged. Just as the rainfall records are taken by observers all over the country and sent to the British Rainfall Association, so it seems to me systematic observations on the occurrence and distributions of the Fungi, carried out on a definite plan, in accordance with rules drawn up by a Committee of the leading Mycologists, might lead to extremely important results, and to the publication of charts and lists of great value.

There is ample scope for members of Natural History Societies in the study of the Micro-Fungi and their life histories; and much remains to be done among those imperfect forms which are probably only stages in the life cycle of a single species, and which are frequently regarded as distinct forms. The life histories of many of the species of Uredineæ for example have been successfully worked out by members of local societies.

The importance of examining Fungi in their natural surroundings cannot be overestimated. If we are to obtain solutions of some of the most interesting problems concerning the Fungi they must be studied as living organisms, and under all sorts of conditions. Observations on their form and structure must be made in order to throw light on their life histories, and the relations of the various forms to one another, and not merely from the point of view of classification. As far as possible they

must be studied under the conditions of experimental investigation. But good systematic work is necessary for the elucidation of biological problems and may prevent vagueness and aimlessness in their investigation. These are frequently the faults of over imagination and speculation, just as dullness and boredom are frequently the results of over much systematic work in which no attention is paid to the deeper problems of life and development.

In recording and comparing the species found in different districts many interesting lines of investigation would be opened up. The geographical distribution of the Fungi, and their relationships to one another and the environment have been scarcely considered. Many of our members who are experienced in the field could no doubt give a fairly complete list of the species to be found in the various plant associations such as a meadow, a moor, an oakwood, beech wood, pine wood, marsh, etc., but this has never, so far as I am aware, been systematically done.

How do the species in any given locality vary from year to year? What are the dominant species? What species occur only rarely? What species are common to more than one formation? How do the species vary in a given locality according to the seasons? In a pine wood, an oak wood, or any other formation, how do the species follow each other from one season to another? How is their succession connected with the environment? 'What are the conditions under which they appear? The nature of the soil, the water content, the temperature may all take a part in determining the species which prevail at any given time. What is the actual effect of a long dry Summer followed by a wet Autumn, or of a wet Summer and a dry Autumn, or of the various other combinations and samples of weather which are such conspicuous features of our climate. We have some rough ideas of the effects of these various factors but we have no precise or definite information concerning them.

A complete answer to such questions doubtless demands elaborate investigation, but even rough and ready methods would be valuable at the present stage, and would give us a clue to the more elaborate methods which it may be necessary to adopt to arrive at a satisfactory solution of the problems later on.

In common with all other plants the nutrition of the Fungi and the development of their form and structure are controlled by external conditions. What are the controlling forces and how do they act? The Fungi are extremely variable. To what extent may these variations be brought about in response to external stimuli? What are the controlling factors in all those changes of form and colour which are exhibited by so many of

the Fungi? What are the limits of variation in size of any given species? How is the variation in colour associated with the environment, the presence of light, moisture, food supply? To what extent have gravity, light, temperature, moisture and variation in nutrition the power to cause a modification of the Fungus form?

Gravity plays an important part in maintaining the pileus in the horizontal position which is, according to the researches of Professor Buller, necessary for the efficient distribution of the spores. In some species light appears to be of importance as a stimulus to the production of the pileus. There are, however, but few recorded observations on these important problems.

Variation in the food supply evokes a very definite modification in the Fungus body, as Klebs, many years ago, showed was the case with *Saprolegnia,* but experimental observations upon the more highly differentiated forms are much needed. Thus it has been shown that the tendency to fruit formation in some of these larger forms may be retarded by changing or weakening the food supply, and somewhat similar effects may be produced by variation in the supply of moisture. Temperature is also known to play an important part in modifying the form and development of the Fungus body. All these problems require further investigation, and it is particularly desirable that observations conducted in the field under the natural conditions of the environment and food supply should be made.

To turn to the more utilitarian aspect of the study of the Fungi. There is still much to be done in the study of Fungus diseases and their life histories. To plant breeders this is of the utmost importance and there is ample scope for largely increased observation in the field.

Then there is the question of edible and poisonous Fungi. This may be a small matter to many of us, but it seems to me that it is of sufficient importance to warrant a more attentive study. It is to be regretted that so large a quantity of excellent food in the form of edible species of Fungi should be allowed to lie and rot for want of a little knowledge to enable one to distinguish them from poisonous or injurious species. A very considerable number of species—Cooke says certainly 70 or 80 common species—may be safely eaten. Those who have never tried the common puff balls, various species of *Hygrophorus, Lactarius delicious* (The Delicious Milk-mushroom), *Tricholoma personatum* (Blewits), *Fistulina hepatica* (Beef-steak fungus), species of *Coprinus, Boletus edulis,* the Morel and many others, have yet much to learn as to the possibilities of this food supply.

It would be a most useful work if Natural History Societies would institute the examination and methods of discrimination

of the common species of edible and poisonous Fungi, by holding exhibitions and giving demonstrations of their structure and of the scientific characteristics by means of which they may be distinguished. As Dr. Cooke points out, 'there are no general rules capable of universal application; whereby edible may at once be distinguished from poisonous Fungi." There are some general characteristics which may be helpful but, and again I quote from Dr. Cooke, "no method is so safe as that which consists in mastering the characteristics of a few species, especially when pointed out by one who is practically conversant with them, and increasing the number with experience."

When we remember the ubiquitous nature of the Fungi, their constant association with all kinds of putrefaction and decay, the part they play as fermentative agents in the production of diseases both of animals and plants, the ease with which they are disseminated through the air or carried about in various ways, their edible and poisonous qualities, their disastrous effects on timber, it is easy to understand how important such a systematic survey as I have suggested to you may be in helping us to a more complete and detailed knowledge of the problems which arise.

Here, in fact, is a piece of scientific investigation in which there can be no manner of doubt that Natural History Societies can take a very valuable share, a piece of work which in many of its aspects is certainly not too difficult nor too indefinite for amateurs, who are prepared to give some little time to the study. Many of the problems are precise and can be definitely stated, and if one of the results of this discussion is that delegates return next year with details of the formation of new Mycological Committees and of work already accomplished, I am quite sure the Conference will welcome them and we shall feel that our deliberations have not been in vain.

In the discussion which followed the reading of the paper the following took part:—Professor Potter, Miss A. L. Smith, Mr. Cheesman, Dr. H. C. I. Frazer, Mr. Stebbing, Sir Daniel Morris and others.

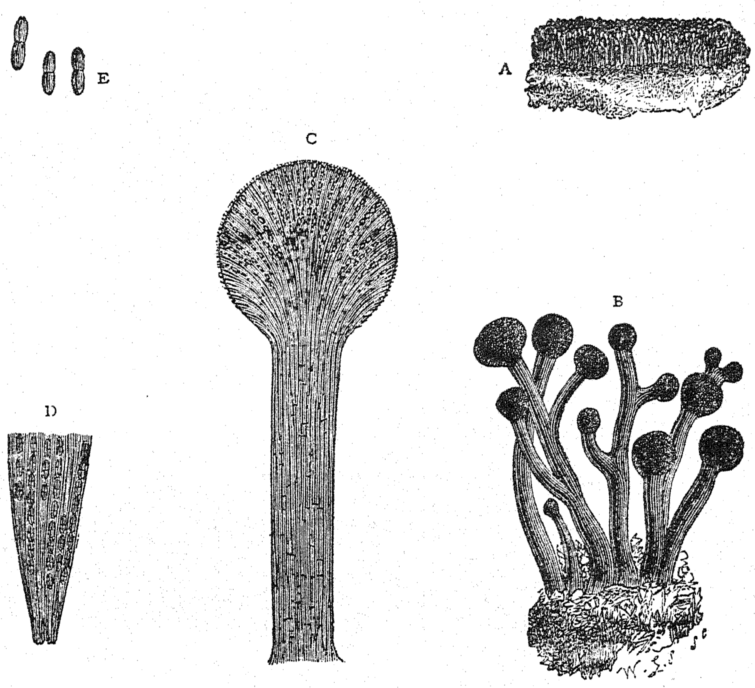
AN ALIEN SPECIES: XYLOBOTRYUM CAESPITOSUM A. L. SM.

By A. Lorrain Smith, F.L.S.

Among the specimens acquired by the Trustees of the British Museum from the late Mr. W. Phillips, there is one which was described and figured by him in the "Gardeners' Chronicle," August 7, 1875, as a new lichen species under the name *Sphinctrina caespitosa.* The diagnosis given by Phillips runs thus:—

Apothecia globose, subglobose or deformed, stipitate, densely caespitose, stipes (from $\frac{1}{4}$ to $1\frac{1}{2}$ line long) horny, often branched; sporidia oblong, rounded at the ends, uniseptate, fuscous, ·0005 × ·00015in.

On decayed fungus, probably *Polyporus,* Hereford, Mr. Griffith Morris.



The figures are reproduced from Phillips' original drawings. A, Plant nat. size. B, A group of specimens magnified. C, Section of an entire plant, seen by transmitted light, magnified. D, Section of the apothecium, more highly magnified. E, Spores very highly magnified.

The specimens are well preserved; the apothecia are densely caespitose, the bases of the stalks penetrating the fungal substratum and then being welded together. They measure about 3 to 4 mm. in height, and are fairly stout; the heads, slightly wider than the stalks, are irregularly globose and measure about $\frac{1}{2}$ mm. across. The paraphyses are numerous and stoutish, but their outline is mostly lost, as they are mucilaginous and coherent. The asci are also indistinct, they are long and narrow, measuring about 6μ in width. The spores are uniseriate, or partly biseriate, in the ascus, brown, 1-septate, $6\text{-}8\mu \times 3\mu$. The form of the upright stroma, the globose perithecia and the brown spores indicate the position of the plant in the fungus genus *Xylobotryum*, one of the Xylariae.

The genus *Xylobotryum* includes very few species collected in tropical regions on rotten wood. It seems to me that the specimens collected at Hereford are due to some accidental infection, and that the fungus has been unable to survive in our cold climate. It is so well-marked, it could not otherwise have escaped being collected once and again.

As described by Phillips it "forms a dense layer covering several inches; the stem is black, shining, and of a horny texture, frequently branched; the head in aged specimens becomes dusty from the breaking up of the hymenium."

The lichen family, Caliciaceae, to which *Sphinctrina* belongs, is characterized by the formation of "mazaedium" fruits, in which the spores become free as they mature, by the breaking down of the asci and remain massed on the disc of the apothecia. The species of *Sphinctrina* are sessile and are usually parasitic on other lichens. The Hereford specimen is not sessile nor is it parasitic on another lichen, and there is no trace of a lichen thallus. The head may be somewhat dusty in old specimens but there is no trace of a "mazaedium." The plant is undoubtedly a fungus belonging to the genus *Xylobotryum*.

ON THE STRUCTURE AND SYSTEMATIC POSITION OF SPARASSIS.

By A. D. Cotton, F.L.S.

In his latest work on our mycologic flora, Mr. Massee alludes to the record of a second species of *Sparassis*, and states that "it is doubtful whether the second specimen was in reality other than a *Stereum*" (1911, p. 433)*. This remark, which naturally caused surprise to those who have seen *S. laminosa*, is not without foundation, the explanation lying in the correct understanding of the *Sparassis* structure. A brief note on the point was prepared. But on looking up the literature, and in view of the interest aroused, it seemed advisable to extend the scope of the paper, and write a general account of the structure and affinities of the genus, the events narrated being given in order of occurrence.

MORPHOLOGY AND STRUCTURE.

Some years ago Mr. Massee received a specimen which, judging by external characters, he unhesitatingly referred to *Sparassis laminosa*. The plant was cast on one side, but a few days later, when casually examining the specimen, it was noted that the upper side of the lobes showed a shiny or silky surface, and that the lower side was pruinose and dried in a different manner. On microscopic examination, it was found that the hymenium was confined to the lower side of the lobes, hence the plant became technically a member of the *Thelephoreae* and not a *Sparassis*. Massee concluded he had made a mistake as to the genus, and regarded the specimen as a *Stereum*, though he did not succeed in identifying it with any British species. It was the above incident that led him to doubt the existence of *S. laminosa* in Britain, and to pen the remark quoted above.

During the past season an attempt was made to clear up the question. Massee's specimens were not preserved, but part of a fresh plant of *S. laminosa* which was procured showed lobes which were fertile only on the under surface. The specimens in the Kew Herbarium were next examined, and these likewise showed, after careful soaking in warm water, a unilateral hymenium.

As *Sparassis* is placed in the *Clavarieae* (where the spore-bearing surface is amphigenous, *i.e.*, covering all sides of the

* See Bibliography at conclusion of paper.

branches), and as the genus is expressly stated to produce spores on both sides of the lobes, it became evident that Massee was correct in assuming that the plant was not a *Sparassis* as described in our floras.

The next step was to examine the ordinary *S. crispa.* Herbarium specimens were soaked up, and it was with some surprise that the same type of structure was found to obtain. All the plants examined showed a distinct sterile and fertile surface, though in some parts of the sporophore this distinction was not present. In response to a request for fresh material, Mr. J. F. Rayner was kind enough to send a magnificent specimen from the New Forest, which proved of great value in clearing up obscure points.

The sporophore of *S. crispa* is, as is well-known, composed of anastomosing plate like branches, the whole forming a globose or somewhat flattened head (see Trans. Brit. Mycological Society, vol. II., pl. 13, reproduced by Swanton '09, plate 28). In the centre of the plant the folds are mostly in a vertical plane, but they anastomose freely in all directions, and towards the periphery spread out more or less horizontally, terminating in free crested lobes (see Smith '08, fig. 106). On examination of the living plant, it was at once evident that the upper and lower surfaces of the lobes were morphologically distinct. In most cases this was discernable to the naked eye, the spore-surface on the under side being pruinose and of a different colour to the sterile upper surface; but where the distinction was doubtful the microscope at once determined the point, as the basidial layer stands out clearly in section. After the entire plant had been vertically bisected, observations were made on the centre of the fruit body. On passing from the periphery to the inner portion, the fertile and sterile surface become less distinct, though in the case of horizontal folds the unilateral hymenium is often retained for a considerable distance. But on the upright branches in and around the centre, and on some of the horizontal folds, the hymenium covers both surfaces; though these internal spore-producing layers appeared to be less productive than the outer lobes.*

An interesting point, noted in the New Forest specimens, may be referred to here, though it forms a digression from the main subject. When, as is not infrequently the case, the outer edge of a sporophore lobe is strongly incurved so as to grow horizontally inwards, the hymenium is found to develop on the lower side of the incurved fold, *i.e.*, on the surface which is continuous with the sterile upper surface of the main branch: and conversely the upper surface of the incurved portion (which was formerly

* Possibly these folds were vertical when young; the weight of a large plant tends to alter the original position of the branches.

the under and fertile) becomes sterile. More rarely a double bend occurs during the growth of the branch, such as would be represented in a longitudinal section of the lobe, by the letter S. Here again the distribution of the hymenium is strictly localized, it being found on the *actual* lower surface of the lobe regardless of the general direction of the main branch. There appears to be no doubt that gravity, and not light, is the determining factor here, and the discontinuous distribution of hymenium shows the extreme sensitiveness of the plant to this stimulus. Prof. Buller remarks ('09, p. 21) that with the exception of certain gelatinous fungi, the spore-bearing surface in *Hymenomycetes* is on the under surface of the fruit body. This position not only ensures protection, but, as Buller shows, is connected with the successful liberation of the spores. He mentions several experiments in which the developing sporophores, in answer to gravity, bring the hymenium into the most suitable plane. In other cases, as in *Lenzites* on a log which has been turned, the plant responds to altered conditions in a different way, namely, by developing gills on the reverse side. It is a response of this nature that takes place in *Sparassis;* the remarkable way in which the hymenium is produced first on one side and then on the other, even in the normal growth of the plant, is very striking. With regard to the morphology of the centre of the sporophores, observations on young plants are required. Critical notes are also needed on the relationship of the hymenium to gravity in resupinate *Hymenomycetes* of all groups.

To return to the general structure of the genus: it has been shown that in *S. crispa* the free horizontal lobes on the exterior (which are exposed to rain and to drying influences) produce spores on the under surface only, but in the interior of the plant, where many of the branches run vertically, the hymenium develops on both sides of the anastomosing plates. In *S. laminosa* to a certain extent the same principle probably obtains, but the wider branches and the more open nature of the plant render internal spore-producing areas much less extensive. There remain for consideration four other species mentioned in Saccardo's Sylloge Fungorum. *S. foliacea,* St. Amans, a French species described in 1821, is practically unknown, the description and figure suggest *S. laminosa.* *S. tremelloides* Berk., from N. America, the type of which is at Kew, proves to be one of the *Tremellineae* and not a *Sparassis.* *S. spathulata* Schweinitz, also an American plant, has erect spathulate branches which become reddish in colour, and are zoned near the apex. The co-type at Kew shows the hymenium on one side of the lobes only. The fourth species, *S. Herbstii* Peck, from Pennsylvania, is said to be closely related to the last. Neither Kew nor the British Museum possess specimens. In addition to the above

the *Sparassis*-like plant described by Cooke and Ravenel as *Stereum Carolinensis*, from North Carolina, may be mentioned. Cooke remarks, in the Journal of Mycology (vol. I., p. 130), that it is allied to *Stereum multizonatum*, and the editors of the journal add that, the plant differs from the usual type of *Stereum* in being "subcarnose and soft and juicy when fresh." The type at Kew shows unilateral hymenium. Judging from the description and from the specimen there can be little doubt that this plant is the same as *Sparassis spathulata* of Schweinitz. As far as can be seen, therefore, the American species of *Sparassis* agree as to the distribution of the hymenium with the British.

Before proceeding to the next section, the microscopic structure of the genus as seen in *S. crispa* may be briefly referred to. The spores are small, hyaline, ovoid or subglobose, a type found in almost all groups of *Hymenomycetes*. The tissue of the sporophore is composed of closely packed, frequently septate filaments, the diameter of which is often considerable, so that the "cells" appear large in transverse section. A few laticiferous filaments also occur, especially in the upper side of the lobes. The basidia and subhymenial layer show no striking features. Air-spaces, which give the tissues of many fungi (*Clavaria* included) a white opaque appearance (as in "stuffed" stems) are largely, if not entirely, wanting, a fact which in part accounts for the moist fleshy consistency of the tissues. On the sterile side of the lobes the surface is remarkably even, the clusters of short filaments that arise being scarcely sufficient to give downiness, even when viewed with a strong pocket-lens.

SYSTEMATIC POSITION.

In view of the facts described above, an enquiry into the systematic position of the genus was rendered necessary. As is well-known, *Sparassis* has usually been placed next *Clavaria*, and largely on the assumption that the spores were produced over the whole surface of the sporophore, though doubtless an additional reason was found in its fleshy consistency. It differed from the *Clavarieae*, however, in its flattened branches, which showed a tendency to become horizontal, and the unilateral hymenium marks a further distinction. But these three characters clearly hang together, for flattened sporophores are nearly always found linked with a horizontal habit and an inferior hymenium. These features are, moreover, those which specially characterise the *Thelephoreae*, in contradistinction to the *Clavarieae*. Unless, therefore, the diagnosis of the latter family be materially modified, *Sparassis* should be removed from it and placed in the former.

Early in the investigation Mr. Rea pointed out that Quélet

had practically placed *Sparassis* in the *Thelephoreae.* In his Enchiridion Fungorum (p. 1) Quélet had two families, characterised respectively by a horizontal and a vertical hymenial surface. The former included most of our *Thelephoreae*, the latter the *Clavarieae; Sparassis* was placed in the former. Quélet modified his system in his Flora ('88, p. 16) but still kept *Stereum* and *Sparassis* together. There is no evidence, however, that he noted the unilateral hymenium; the frondose habit was apparently the link between the two genera. His groupings, moreover, are of no great value, as in many cases they are clearly unnatural.

On turning to the *Thelephoreae* we find that the sporophore in this family presents great variety in form, size and texture. Some genera are frondose, such as *Thelephora*, others *Corticium* and *Peniophora*, for example, are resupinate, *Stereum* combines the resupinate type with various others, *Craterellus* is funnel shaped, *Exobasidium* is parasitic on leaves, whilst *Solenia*, *Cladoderris* and *Cyphella*, together with several remarkable tropical genera, afford further types of sporophore development. Most of the genera are tough and coriaceous, but a few such as *Aldridgea*, *Soppittiella* and *Craterellus* are fleshy or subgelatinous. The unilateral hymenium is common to all, but the use of this character has brought together plants that are not closely related and the family is thus somewhat artificial, and in striking contrast to the *Clavarieae.* As is well-known, Patouillard in his Essai sur les Hyménomycètes (1900, p. 37-73) ruthless splits up this unnatural family. When drawing attention to the Essay at the Drumnadrochit Foray, Mr. Rea described the outlines of Patouillard's classification, and the fate of the *Thelephoreae* will be seen on referring to his address (Transactions 1908, p. 63-65). Briefly summarized, *Thelephora* (emended), *Stereum* and *Corticium* each become centres around which different genera are grouped, whilst *Cyphella* forms the basis of a tribe and *Exobasidium* of a family. On looking up *Sparassis* one is surprised to find Patouillard states that the hymenium is amphigenous, and that, though he had previously placed the genus in the Thelephoreae (1887, p. 150) he now restores it to the *Clavarieae* (1900, p. 46).

Whether Patouillard's classification be accepted or not, it is clear that if *Sparassis* is to be placed in the *Thelephoreae* it will be located near *Stereum* or *Thelephora*, and that other plants need not be discussed here. On examining these genera, we find in the *Merisma* section of *Thelephora*, sporophores which in form somewhat resemble *Sparassis*, and a few of the more erect growing species are partly amphigenous; the plants are mostly coriaceous, dark-coloured, and the hymenium surface is rough or warted, with coloured or hyaline spores: many are terrestrial

but others grow on wood. In *Stereum* the sporophore is resupinate or reflexed, though in the tropics merismoid and central stemmed forms are found. They occur on wood and are usually coriaceous: the hymenium is smooth and bears small hyaline spores. On the whole *Sparassis* appears to be more nearly allied to *Stereum*, the even hymenium being an important character. The relationship, however, is not very close, but there is no reason why it should not be placed in the same family.

With regard to the *Clavarieae*, the introduction of an important change in the diagnosis of the family on the strength of a genus of doubtful affinity is highly undesirable, the more so since there is no reason why *Sparassis* should not be placed in the *Thelephoreae*. The course for the systematist therefore seems clear. Our classification is based mainly on the morphology and structure of the sporophore, and it appears to the writer that the morphological characters of flattened horizontal branches showing unilateral structure must be respected. He would, therefore, without implying affinity with any particular genus, place *Sparassis* in the *Thelephoreae*, where it would be distinguished by its branched, anastomosing, fleshy sporophore of terrestrial habit. The *Clavarieae* would thus remain a well-defined family, characterised by simple or branched sporophores of more or less erect growth with the hymenium developed equally on all sides. The typical genera are fleshy, but *Pterula*, usually included in the group, is coriaceous. The above view may not commend itself to all, but it will be admitted that changing the position of a single genus is a less risky alteration than modifying the diagnosis of a family.

It is interesting to note that *Clavaria* and *Sparassis* are widely separated by our member Prof. René Maire. His important treatise on the Basidiomycetes ('02) was purposely not referred to in the above discussion, as his work was on very special lines, and the point of distinction between the genera in question could not be introduced into our classification. After carrying out an amazing amount of cytological investigation on a large number of *Basidiomycetes*, M. Maire propounded (in the paper mentioned) a scheme of classification. The two main divisions of the *Hymenomycetes (Euhymeniales)*, as proposed by him, are founded on differences in the minute structure of the basidium. It is a relief to find that with the use of these characters most of the larger families remain intact; but in some there is a cleavage. The *Clavarieae* proper come down in one section, and *Sparassis* in the other; the *Thelephoreae* are likewise divided, and are further broken up into a number of families. *Sparassis*, which is the subject of a short note, is made the type of a special family, the *Sparassideae* (p. 100; Lotsy '07, p. 697),

but it is far removed from the genus *Thelephora*. *Stereum* was not investigated but is provisionally placed next the last named. Whether Maire's classification will be generally adopted remains to be seen, but it should be noted that Lotsy selects it in preference to others in his Vorträge ('07), a work which is largely used in colleges and universities both in England and abroad.

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EUROPEAN FUNGI IN THE TROPICS.

By T. Petch, B.A., B.Sc.

The earliest records of Ceylon Fungi are to be found, fide Berkeley, in the thirteenth edition of the Systema of Linnaeus. I have only been able to consult a Dutch version of that work, published in 1783; in that there are only two Ceylon records. Apparently nothing further was recorded until 1842, when Berkeley described several Ceylon Fungi which had been collected by König in 1777-1781, and had been stored in the British Museum during the intervening 60 years. Up to 1846, about twenty Ceylon species had been recorded, but after that date names began to accumulate much more rapidly. In 1847, Gardner sent a collection of about one hundred and twenty species to Berkeley; his successor, Thwaites, also sent small consignments from time to time and finally, about 1868, overwhelmed Berkeley and Broome with a collection of some twelve hundred gatherings. Both Gardner and Thwaites appear to have had some doubts as to the value of this kind of work, for each of them took the trouble to send paintings of at least the agarics. Gardner's paintings are poor; the figures are much reduced and they are somewhat "impressionist"; in some cases it is impossible to decide from the painting whether the figure represents an agaric or not. But the paintings which were executed by de Alwis under Thwaites' supervision are the best figures of agarics I have ever seen.

Thanks to Thwaites' work, the Ceylon Fungi were allowed to rest for over thirty years, except for the periodic juggling of the herbarium specimens. Various visitors have added a few new species, but fortunately we have not been troubled with many. The species maker has not cared to visit a country where so many species have already been described. At the present time the published records of Ceylon Fungi contain about fifteen hundred names.

Now, this is the state of affairs which confronts every mycologist who takes up work in the Tropics. He has to deal with a host of names which have been accumulating for more than a century, and with *so-called descriptions which do not refer to any living Fungus*. There are two ways open to him. He may accept all that has already been written, and continue the same work, collecting all the Fungi he happens to meet and forwarding them to Europe to be named. But if he tries to

recognise, from the descriptions, the species he has sent, he will soon come to the conclusion that such work is useless. Unfortunately, few of the people who forward these miscellaneous consignments take any further interest in the matter.

The alternative is to collect all the existing records and descriptions, and to try to fit Fungi to them. But this is an extremely slow business, and I often regret that I undertook it. It is very much easier to make new species. As a result of six years' work we know what about half the Ceylon names refer to.

During the last few years, I have had the good fortune to meet the two mycologists who are taking the lead in clearing up the present mycological chaos, namely, Mr. C. G. Lloyd and Prof. F. v. Höhnel. Their comments were identical. They agreed that a revision of the Ceylon Fungi was desirable, but doubted whether the facilities for such work in Ceylon were adequate. I am glad to say that I was able to convince both of them that the facilities in Ceylon were not only adequate, but unequalled elsewhere. We have the co-types, and in many cases, the types, of the species collected by Thwaites and named by Berkeley and Broome; and we have in addition the original paintings from which (and not from the specimens) the Ceylon agarics were described. In that respect we stand alone among British Colonies: for in no other case were specimens and paintings (where any existed) returned.

Several interesting results have followed from this re-examination of tropical Fungi on the spot. The genera which we transfer from one place to another in our text books were founded in many cases on immature specimens, in others on freaks of nature, and in yet others on freaks of the imagination. Theories of the evolution of the different forms of Fungi have been based on species which never existed in the form described. Parallel species are found in different groups solely as a result of misdescriptions; e.g., ANTHRACOPHYLLUM is said to be a *black-spored* genus *with split gills*, corresponding with the *white-spored* SCHIZOPHYLLUM, yet ANTHRACOPHYLLUM really has *entire gills* and *white spores*. But it is among the agarics that the greatest confusion exists; and the results prove, what might have been expected, that it is impossible to describe, or identify, or even classify generically, a dried agaric. Among the Ceylon Fungi, the same agaric occurs sometimes under half-a-dozen different names and often in two or three genera, all described at the same time by the same authors. Each of our common Ceylon LENTINI has been named about six times; and when it is realised that the same sort of thing has occurred to *the same species* in most other tropical countries, some idea of the present state of affairs may be imagined.

Among the Fungi recorded for Ceylon we find the names of many European species, and it is to those that I wish specially to direct your attention. Gardner's collection included one hundred and thirty-five numbers, four of which were too imperfect to be named; of the remainder, fifty-two were assigned to European species. Thwaites' main collection included about twelve hundred species, and of those less than two hundred were assigned to European species. This comparison is most instructive, Gardner's figures were very imperfect and more than one-third of his species were said to be European. When Thwaites sent better figures the European species numbered only one-sixth of the collection, in spite of the fact that it included over fifty cosmopolitan mycetozoa. If we confine ourselves to the agarics, we find that Gardner sent forty-two species, twenty-seven of which were European, while Thwaites sent three hundred and thirty-four species, forty-six of which were European. The proportion of European species drops from two-thirds to one-seventh.

When fresh specimens are found, to match the old specimens and paintings, most of the supposed European species prove to be something quite different. The *Lepiota procera* of Gardner's collection is the *Lepiota dolichaula* n.sp. of Thwaites'; this is a tall species, sometimes eighteen inches high, with a smooth pileus, but if the weather turns dry when it is expanding, the pileus becomes scaly. Gardner did not send any figure of this species: his specimen was a tall, scaly, *Lepiota*, and therefore was attributed to *procera;* but when Berkeley and Broome saw Thwaites' figure they recognised that it was a new species. But they did not recognise that it was in any way related to the specimen which Berkeley had assigned to *procera*, twenty years previously.

The Ceylon record of *Lepiota cepaestipes* Sow. is I believe correct. Our species is always yellow, never white. But it scarcely resembles the figures in Cooke's Illustrations. When unexpanded it is exactly hour-glass shaped, the diameter of the inflated stalk equalling that of the unexpanded pileus. When expanded, the pileus is membranous, and plicato-sulcate almost to the centre; it is *Hiatula*, rather than *Lepiota*. The gills are yellow, not white as given in Saccardo.

Lepiota granulosa Batsch was merely a convenient dumping ground for small forms of various Ceylon species. There are certainly two or three species included under that name, and none of them is *granulosa*.

The species attributed to *Tricholoma nudum* resembles the latter somewhat in colour, but it differs in being always acutely umbonate. Berkeley and Broome named it twice, the second name being *Clitocybe laccata*, var. *amethystea*.

Our *Russula emetica* is really a white species which turns red when attacked by a *Hypomyces.* In its normal condition it is *Russula periglypta* B. & Br.

The species referred to *Clitocybe candicans* P. has pink spores: it was named twice, being included among the *Lentini* the second time.

Of the first one hundred and fifteen white-spored agarics of Thwaites' collection, only eight were attributed to European species; but when we come to the *Mycenæ* we find that of sixteen species seven were said to be European. These are nearly all minute species which it is impossible to make anything out of when they are dried. This illustrates the general rule that when the material is bad the percentage of European species increases.

Gardner is supposed to have collected *Pleurotus dryinus;* Thwaites did not, but he sent our common Ceylon *Pleurotus*, and it was named twice, *Pleurotus angustatus* and *Pleurotus flabellatus.* There is no doubt that these three names refer to the same species in Ceylon. It is soft and smooth, generally white but sometimes pink.

There is a very common Ceylon *Pluteus* which grows in troops round decaying stumps. It resembles *cervinus* in general appearance, and when Gardner sent it to Berkeley it was referred to *cervinus.* But when Thwaites sent it, it was referred to *cervinus* and *nanus*, and a number of new species. How many new species it represents I have not yet determined, but the number seems to be about eight. It is very variable, but there is one character which runs through all its forms, namely, that the centre of the pileus is scabrous.

Among the Entolomas we have *Entoloma rhodopolium* recorded. Our species which was so named is infundibuliform and has a striate margin: it is not umbonate: the pileus is greyish-brown with dark radial streaks; the stalk is greyish-brown and solid.

In Thwaites' collection Berkeley and Broome found *Flammula sapinea* "on dead wood, evidently of some conifer." This proves to be a very common species on dead coconut, the "wood" of which may, at a casual glance, be mistaken for pine. Its earlier stages were named *Armillaria rhodomala* n.sp., while the mature form was named *Flammula dilepis* n.sp., *Flammula sapinea* and *Naucoria furfuracea.* Needless to say, it is neither of the last two. When Gardner sent it, it was apparently named *Hypholoma sublateritium.*

Fifteen Ceylon species of *Naucoria* have been recorded, of which seven are European. Two of these have been determined up to the present. "*Naucoria furfuracea*" is the *Flammula* just mentioned, and "*Naucoria pediades* var. *major*" is a *Psalliota.*

In *Psalliota*, we have records of *Ps. campestris*, *Ps. arvensis*, and *Ps. sylvatica*. The species attributed to *campestris* was also named *endoxantha* n.sp., because the stem turns yellow internally when cut, but it has several other names. I have never met with *arvensis*, and it is scarcely possible to say what it really was from Gardner's figure; it was collected by Gardner, but not by Thwaites. "*sylvatica*" is a stout species, with the stalk and pileus shaggy with red-brown scales; it is distinguished by the colour of the gills, which are at first dingy cream coloured becoming yellow when cut.

Marasmius, *Lentinus*, and *Panus* account for seventy-three species in the records, but not one of them was given a European name. In the *Polypori*, a few (six out of sixty-five) were said to be European species, but the specimens so named were in some cases too poor to be identified. The specimens of *Fomes fulvus*, for example, are undeterminable. On the other hand Lloyd considers that the Ceylon specimen of *Polyporus sulphureus* at Kew is correctly named. But in the section *Poria*, seven out of twenty-one were said to be European. This appears to be another illustration of the general rule.

These erroneous identifications are not confined to Ceylon lists or to British mycologists. The Ceylon Fungi have been determined under exceptionally favourable conditions; for paintings of nearly all the agarics were submitted with the specimens. If under such circumstances, the results are unreliable, how much reliance is to be placed on diagnoses made on dried specimens only? Judging from Ceylon experience, I should say that all descriptions of dried agarics are worthless, and most of the identifications inaccurate, but the question can only be solved for each particular country by a mycologist on the spot, for nothing can be decided from a list of mere names. Only on rare occasions are particulars added which prove, to mycologists in the Tropics, that an identification is incorrect. For example, a list of Javan Fungi, identified by Patouillard, begins with *Collybia radicata*. Now, every beginner knows *Collybia radicata*, and I suppose we all consider that we could identify it, fresh or dried; so the record passes unquestioned as another instance of the occurrence of European Fungi in the Tropics. But Patouillard adds that, to the base of the stalk there was attached a curious mass which resembled a piece of sponge; and that detail makes it clear that he had not *Collybia radicata*, but *Volvaria eurhiza*, the fungus which grows from termite nests, for the spongy mass was undoubtedly a piece of the termite comb.

Such identifications are based purely on superficial resemblances. Any agaric with a rooting base is *Collybia radicata*, every tall rough *Lepiota* is *procera*, every violet agaric is

Tricholoma nudum, and so on. What else is possible? We may welcome these mistakes because they obviate the publication of new species with imaginary descriptions, but it should be clearly understood that such records are quite worthless as a basis for theories on the geographical distribution of Fungi. Of course, it is well known that many species are cosmopolitan, *Schizophyllum commune*, for example; but, on the other hand, the *Fomes lucidus* of the Tropics is apparently not the same as *Fomes lucidus* of temperate climates, though it has been considered so for about a century. I think it will be found that temperate species do not occur in the Tropics to the extent which has been supposed.

I have said that these identifications are based on purely superficial resemblances; and I would venture to point out that the available descriptions of agarics often do not contain anything else. Probably an example will make my point clearer. We have a *Mycena* which Berkeley and Broome assigned to *tenerrima*. Its pileus is covered with loose cells which are characteristically ornamented with spines. In comparing it with *tenerrima*, I want to know the character of the minute granules which occur on the pileus of the latter, but none of the text books give any information on the point. Again, we have a *Coprinus* which in many particulars matches *Coprinus domesticus*, but its stem is covered with short, erect, capitate hairs; the stem of *domesticus* is described as silky, but what is the character of the hairs? It seems to me that there is room for further work in this direction. In the Tropics, at least, microscopic characters (by which I do *not* mean spore measurements) afford valuable evidence in many cases, and it does not seem probable that they should be entirely useless in temperate countries.

If temperate species occur in the Tropics, there is no reason why tropical species should not occur in temperate climates; and accordingly we find that several Ceylon species have been discovered in England. One of the most notable of these is *Lepiota licmophora*, which is rather an uncommon species in Ceylon. In general appearance it is a yellow *Coprinus*. Its pileus is plane, about one inch in diameter, and radially plicato-sulcate almost to the centre. The centre is a slightly convex disc, 3 to 5 mm. in diameter. This disc is either pale-brown or greenish-yellow, and smooth: the crests of the ridges are clothed with sulphur-yellow or greenish-yellow flocci, but between the ridges the pileus is hyaline, and somewhat transversely wrinkled. Except in the central disc, the pileus is membranous. The stalk is 6 to 9 cms. high, attenuated upwards, about 2 mm. diameter at the base, and 1 mm. diameter at the apex, very pale greenish-yellow with a few flocci, or white and almost glabrous, hollow, white internally, and sunk into the central disc. The ring is

about one-third the length of the stalk from the apex, small, yellowish, and evanescent. The gills are white, transparent, narrow, equal; nearly all of them reach and are attached to the central yellow disc which surrounds the apex of the stalk. The spores are white, broadly oval with a papilla at either end, that is, lemon shaped, and measure 11-13 × 7-8μ.

This species is represented in Cooke's Illustrations, Pl. 1179. The figures in the upper right- and left-hand corners are copies of the original Ceylon paintings, but they have been copied very badly. Both are represented as sulphur-yellow throughout, but in the original of the left-hand figure, the pileus is brownish-yellow in the centre, greenish-yellow along the ridges, and white in the furrows, while the stalk is white with a tinge of yellow; and in the original of the right-hand figure the gills and the interior of the stalk are white. Further, the pileus in the original is plicato-sulcate up to the disc, while in the copy it appears to have little more than a striate margin; and the attachment and shape of the gills are also reproduced incorrectly. The remainder of the figures on Cooke's plate resemble the Ceylon *L. cepaestipes* rather than *L. licmophora*. They are certainly not the latter species. The spores of *cepaestipes* are altogether different from those of *licmophora*, being broadly oval or subglobose, 5-7 × 4-5μ.

In Massee's British Fungus Flora, vol. III., p. 247, *L. licmophora* is said to be entirely pale lemon-yellow, and distinguished from *cepaestipes* by the glabrous pileus. Both these characters are wrong. From the paintings I have seen, I should say that what passes for *licmophora* in England is only a form of *cepaestipes*. The true *licmophora* is, I believe, identical with *Leucocoprinus flavipes* Pat.

Another Ceylon *Lepiota* found in England is *Lepiota metulaespora;* but again I have to dissent. In Ceylon this species grows among dead leaves from a white thread-like mycelium. Its pileus is 2·5-4 cm. diam., broadly campanulate, and obtusely umbonate; the umbo is yellow-brown or reddish-brown, and smooth; elsewhere the cuticle is broken up into thin, floccose, adpressed scales or warts which vary in colour from pale brown to whitish, and are somewhat concentrically arranged. Under the scales, the pileus is white and silky-fibrillose. It is sulcate half-way to the centre; the flesh is thin and white; and the margin is sometimes appendiculate. The stalk is 6-9 cm. high, 3 mm. in diameter, slightly swollen at the base, densely clothed with white fibrils, yellowish when the fibrils are rubbed off; it is hollow, turns yellow brown when cut, and is lined with shining white fibrils. The gills are white, free, rounded at the outer ends, and doubly rounded behind, ventricose, up to 7 mm. broad. The veil is fibrillose and evanescent. The spores are white, 2 to

6-guttulate, and measure $15\text{-}18 \times 5\text{-}7\mu$; in one aspect they are fusiform with sharply pointed ends, in another they are uniformly curved on one side but sigmoid on the other. I cannot trace much resemblance to a ninepin.

In the original figure, the stalk is yellow and glabrous, because the fibrils had been rubbed off. The scales on the pileus in that figure are depicted as thin, square warts, rather than scales, i.e., they do not merge into the pileus at their upper ends. The figure in Cooke's Illustrations appear to be quite a different species; it is a different shape, is more scaly, and the flesh is thicker; it has a ring with a brown edge and the gills are tinged yellow above. The Ceylon *metulaespora* resembles *zeylanica*, from which it differs mainly in the comparatively long and thin, fibrillose stalk. From the figures which I have seen of the British species I think the latter is not *metulaespora*.

Next we have *Lepiota biornata* B. & Br. Here I am unable to give any definite information, but I am under the impression that the Ceylon species will be found to be an immature *Psalliota*.

The Ceylon *Pluteus spilopus* is recorded for England. The only thing we can fit to this description and figure in Ceylon is one of the forms of our common *Pluteus*. But the description of the English *spilopus* says that the pileus is radiately rugulose, a character not found in the Ceylon species; and it makes no mention of the scabrous centre.

Finally, not to weary you longer, I may mention *Hygrophorus bicolor*, originally found in Ceylon, and recorded for England in the Naturalist, November, 1902. As far as I have been able to determine, *Hyg. bicolor* is the common Ceylon *Hygrophorus*, *Hyg. roseostriatus*, in course of dessication. The figure of *bicolor* fits specimens of *roseostriatus* drying from the margin upwards. The revision of the Ceylon records proves that it is impossible to identify an agaric from a dried specimen; and consequently that the records of European species in the Tropics are untrustworthy. It also proves that it is impossible to draw up accurate descriptions from dried specimens; and consequently that those who rediscover tropical species in temperate climates are relying upon descriptions of agarics which never existed. Mycologists who compile descriptions of dried agarics are merely wasting time; if it were only their own time it would not matter so much, but they are wasting also the time of others who have to fit fungi to their descriptions. Personally, I think that it is fully established that tropical mycology, to be of any value, must be studied in the Tropics. There are very few groups which can be dealt with satisfactorily merely from herbarium material.

THE PRODUCTION AND LIBERATION OF SPORES IN THE GENUS COPRINUS.

By Professor A. H. Reginald Buller, D.Sc., Ph.D., F.R.S.C.

A lecture with the above title was delivered before the British Mycological Society at its annual meeting in September last. The following are some of the observations which were mentioned.

In the Agaricineae there are two distinct spore-producing and spore-liberating types of fruit-body—the Coprinus type and the Mushroom type—which differ from one another in several structural, functional, and developmental details. The Coprinus type is specialized whilst the Mushroom type is generalized. There is evidence to show that, in the course of evolution, the latter has given rise to the former. Among the more highly evolved species of Coprinus may be mentioned:—*Coprinus atramentarius*, *C. narcoticus*, *C. stercorarius*, and *C. macrorhizus*, all of which possess cystidia, and *C. comatus* and *C. sterquilinus* which do not. In the first group of species the cystidia serve to keep the delicate gills apart, so that the spores on hymenial surfaces of adjacent gills are prevented from touching one another during development. On the other hand, in the second group of species, where cystidia are absent, the separation of the gills is provided for by the free margins of the gills which are swollen into sterile bands or flanges.

In *Coprinus atramentarius* the gills are *parallel-sided*, and thus differ from those of the Mushroom, etc., which have their sides inclined like the sides of the blade of a pen-knife. The parallel-sidedness of the gills in this and other species of Coprinus permits of the gills having considerable depth, and yet of being constructed with much less material than equally deep gills of the Mushroom and other Fungi of the Mushroom type.

In the Mushroom, etc., owing to the gills being shaped like the blade of a pen-knife and being positively geotropic, under normal conditions every part of the investing hymenium looks more or less downwards towards the earth. This enables every part of the hymenium (every square mm.) to produce and liberate spores successfully at the same time. In *Coprinus atramentarius*, on the other hand, on account of the gills being parallel-sided and incapable of giving a positively geotropic response to the stimulus of gravity, it is not possible for both sides of a gill to look downwards at the same time. Usually one side looks slightly downwards and the other slightly upwards. It would not, therefore, be possible for such a gill to liberate spores from

every part of its hymenium successfully at the same time. The spores on the surface inclined slightly upwards, after being shot out into the interlamellar space, would fall on to the gill, adhere there, and be lost.

The successful liberation of the spores from the parallel-sided gills of *Coprinus atramentarius* is brought about by special adaptations of which the following are the chief:—(1) The spores ripen in a progressive zone from below upwards on each gill. (2) The spores are discharged in succession from below upwards on each gill. (3) The spore-freed portions of the gills, as soon as they have come into existence, are destroyed by autodigestion. It takes from one to two days in *C. atramentarius* for the zone of spore-discharge, with the closely-following spore-freed zone and autodigestion zone, to move upwards from the bottom to the top of each gill. The spore-freed portions of the gills which are of no service to the fruit-body, are removed by autodigestion out of the way of the falling spores, and are thus prevented from becoming mechanical hindrances to the escape of the spores still being discharged. The zone of spore-discharge is always less than 0·5 mm. above the free gill edge. Since the spores are shot outwards into the interlamellar spaces to a distance of about 0·1 mm., and since they only have to fall downwards a distance of about 0·33 mm. between the gills before reaching the exterior of the fruit-body, they are able to escape from both sides of a gill even when this happens to be tilted to an angle of several degrees. Autodigestion (deliquescence) of the gills, which for so long was merely a meaningless and puzzling phenomenon, is now seen to be a necessary and important factor in bringing about successful spore-liberation in the Coprinus type of fruit-body.

The hymenium in the genus Coprinus (neglecting the cystidia which are present in some species and absent in others) consists of fertile basidia and of definite, constantly-occurring, sterile paraphyses. The latter function as *spacial agents* in that they prevent the spores of adjacent, simultaneously-maturing basidia from touching one another.

The writer discovered in the spring of 1911* that the basidia of most species of Coprinus *(C. atramentarius, C. comatus, C. sterquilinus, C. stercorarius*, etc.*)* are *dimorphic*. Long obviously-protuberant basidia and short practically non-protuberant basidia are interspersed among one another and the paraphyses so as to form a mosaic-work which is of such a kind that the spores of the long basidia are further from the surface of the hymenium than the spores of the short basidia, and so that they frequently overlap the latter without touching them. The

* In my "Researches on Fungi," Longmans, Green & Co., London, 1909, only the long, protuberant basidia are shown in the drawings of the hymenium of *Coprinus comatus*. The short basidia were left out, as they were then thought to be exceptional. Illustrations of the hymenium of various species of Coprini with correct details concerning the dimorphism of the basidia are in course of preparation for publication.

dimorphism of the basidia permits of a closer packing of the basidia on the hymenium than would otherwise be possible. Hymenial space is thus economised for spore-production. It was observed in *Coprinus sterquilinus* and *C. comatus* that in the zone of spore-discharge which proceeds upwards on each gill, the long basidia discharge their spores a short time before the immediately-adjacent short basidia. The spores of the short basidia, at the time when they are shot out into the interlamellar spaces, are thus prevented from colliding with the spores of the long basidia. In *C. micaceus* the basidia are more or less *trimorphic*.

The dimorphism and trimorphism of basidia are reminiscent of the dimorphism and trimorphism of stamens which in numerous flowers are beautifully significant in the process of cross-pollination.

Until discovering the fact of the dimorphism of the basidia, I was puzzled as to the significance of the striking protuberancy of Coprinus basidia. Now that the advantage gained by this protuberancy has been explained, the conclusion seems inevitable that such a fruit-body as that of *Coprinus atramentarius* is organized even in regard to the minutest details of the structure and function of its parts, so that it may attain the highest efficiency as a whole in the production and liberation of its spores.

I have noticed that the mycelium of Coprini (also that of many other Fungi) retains its vitality when dried in the medium in which it is growing. At the September Meeting of the British Mycological Society, I requested that members would be so good as to send me species of Coprinus in the mycelial condition. Since the meeting Miss E. M. Wakefield has sent me two species which she found growing on sticks at Kew. The sticks were simply allowed to dry and were forwarded to me at Winnipeg. On their arrival they were moistened, and new fruit-bodies soon came up. I was therefore enabled to make a careful study of these species and to determine their macroscopic and microscopic characters. Both species proved of interest. One, which may perhaps be called *Coprinus bisporigera*, has but two spores on each basidium as a rule, but a small proportion of the basidia have just one spore each. The unisporigerate basidia possess spores about twice as large as those produced by the bisporigerate basidia. The other species which perhaps may be called *Coprinus echinosporus* has distinctly echinulate spores. Mr. A. D. Cotton has sent me a species in dried dung which is also yielding fruit-bodies. Mr. T. Petch has provided me with a species which may be *Coprinus domesticus*. To the senders of the material just mentioned I am much indebted and here wish to express to them my best thanks. I should be glad to receive further material, as in the course of time I hope to give a comparative account of the Coprini.

BRITISH GEASTERS.

By Carleton Rea, B.C.L., M.A., &c.

With Plates 17, 18 and 19.

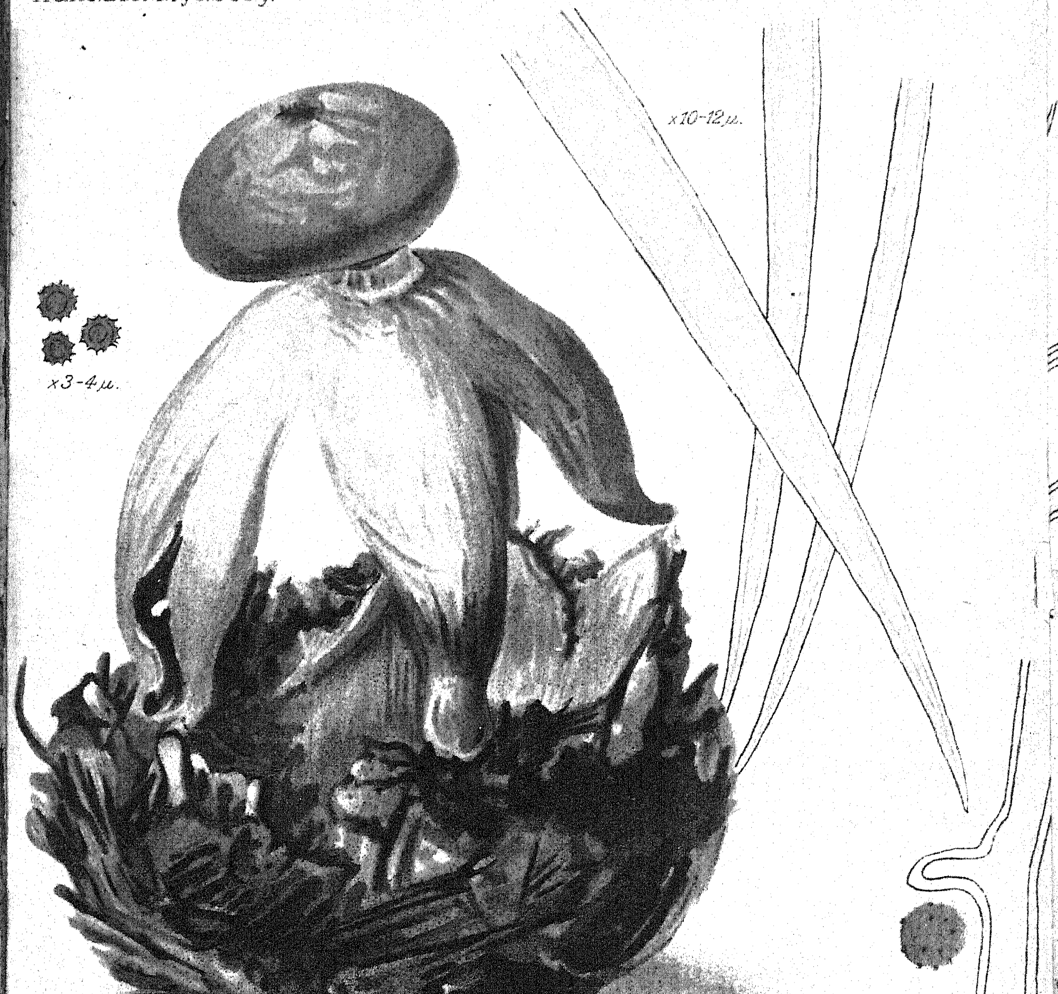
Last year Dr. Paul suggested to me that I should write a paper on our British Geasters so that students in the field might be able to identify the species met with. We have about fifteen species of Geasters and these may be very well classed under three different genera, MYRIOSTOMA, ASTRAEUS and GEASTER. For my own part I think that a fourth genus might well be created for the fornicate species and called FORNICATUS. This breaking up of the old genus Geaster into several genera is, I hold, not iconoclastic but rather an assistance in the ready determination of species in the field. All Geasters or Earth-Stars when young exactly resemble a Lycoperdon (Puff-ball), but it is a somewhat curious fact that some of the older mycologists failed to recognise them in this state and created for their reception such genera as DIPLODERMA Link and CYCLODERMA Klotzsch.

But in its mature condition a Geaster is very different from a Lycoperdon. The outer layers (the *exoperidium*) split back and elevate a smaller globose body (the *endoperidium*) and we then seem to have a small Puff-ball seated on the exoperidium which is either *sessile* or *pedicellate*. In MYRIOSTOMA the endoperidium has *several mouths and pedicels*, whereas in ASTRAEUS and GEASTER the endoperidium has only *one mouth and a single pedicel*. MYRIOSTOMA COLIFORMIS (Dicks.) Pers. is the sole representative of this genus in Britain and is therefore easily identified by its generic characters. It is of rare occurrence and has been met with in Norfolk and Worcestershire. ASTRAEUS Morgan differs from GEASTER Fr. in having *no columella* and the threads of the capillitium are *branched*. Up to the present time ASTRAEUS HYGROMETRICUS (Pers.) Morgan (Plate 17) is the only species of this genus that has been found throughout the world. It is very easily identified by the *very firm, almost horny* segments of the exoperidium being *very strongly incurved* over the sessile endoperidium when the plant is in a dry state, whereas it stands up on the recurved segments when it is in a moist condition; hence the appropriateness of the specific name. GEASTER MAMMOSUS Fr. resembles ASTRAEUS HYGROMETRICUS in this respect, but the texture of the *exoperidium is very much thinner* and the sessile inner peridium has a *well defined, even, conical mouth*, whereas in ASTRAEUS HYGROMETRICUS the inner peridium dehisces by a *simple, torn opening*.

The remainder of our British Geasters do *not* have the segments of the exoperidium *strongly incurved* over the endoperidium *when dry.* In the following eight species the endoperidium is *pedicellate* and the first four of these have endoperidia with *sulcate mouths.* GEASTER BRYANTII Berk. (Plate 18) is one of the commonest of these and it is easily recognised by the *deep, circular groove* at the base of the endoperidium which is seated on a thin pedicel and has a long beaked mouth. I found this groove absent in some specimens that I gathered in a fresh growing condition, but after the lapse of a day or two this was apparent in them all. GEASTER SCHMIDELII Vitt .is a rare plant of similar appearance to GEASTER BRYANTII but it is *much smaller* and has a *short, stout pedicel without any groove* at the base of the endoperidium which has a short beaked mouth and the *inner layer of the exoperidium is whitish* in colour. GEASTER ASPER Lloyd (Plate 18) (=GEASTER BERKELEYI Massee) is somewhat like GEASTER BRYANTII but there is *no groove* at the base of the *verrucose* endoperidium, which has a short beaked mouth and is seated on a short thick pedicel. GEASTER SMITHII Lloyd, is a much smaller plant with a very short stalk to the endoperidium and its conical, sulcate, striate mouth is *seated on a depressed area.* It was well described and figured by Worthington G. Smith under the erroneous name GEASTER STRIATUS DC.* The two other British Geasters with pedicellate endoperidia have *smooth* mouths and *strongly revolute* exoperidia. They are of large size and chiefly distinguished by their colour. GEASTER RUFESCENS Pers. (Plate 19) has the inner layer of the exoperidium of a *reddish flesh* colour and this layer is some four or five millimetres in thickness when the plant is quite fresh, but when it becomes weathered this layer often breaks away in flakes or dries up almost completely, with the result that very little of it can be detected in old worn out examples. The endoperidium is sometimes sessile but in the majority of cases it is shortly pedicellate. Most of our text books describe the mouth of the endoperidium as toothed, whereas in fact it is only occasionally torn, and too much importance has been attached to this character. GEASTER LIMBATUS Fr. (Plate 18) is a *dark blackish brown* plant and has a more distinctly pedicellate endoperidium than GEASTER RUFESCENS. GEASTER TRIPLEX Jungh. is recorded as British by Worthington G. Smith in his British Basidiomycetes, p. 471 (1908) and Lloyd in The Geastrae (1902), at p. 26, says that he "thinks English botanists have mistaken it for GEASTER RUFESCENS. The character generally given to distinguish TRIPLEX, namely, the remains of the fleshy layer forming a cup at the base of the inner peridium, while usually present, should

* Gard. Chron. (1873), 469.

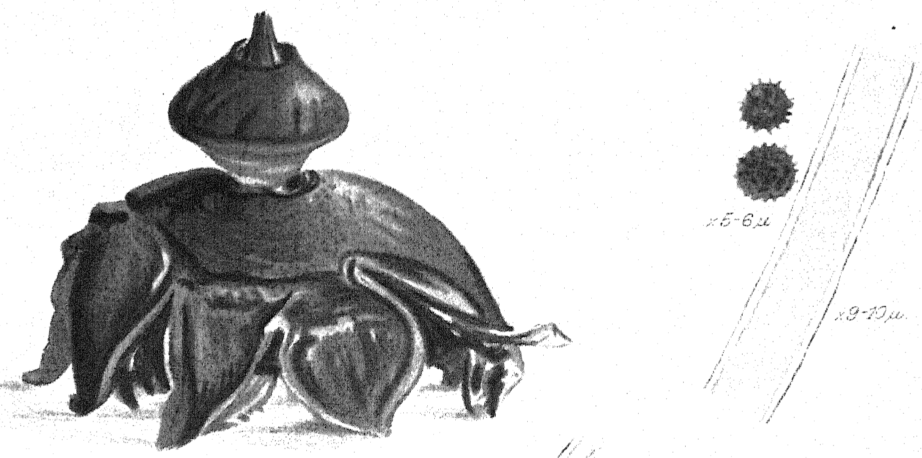
Myc. Socy. Vol. III. Pl. 1



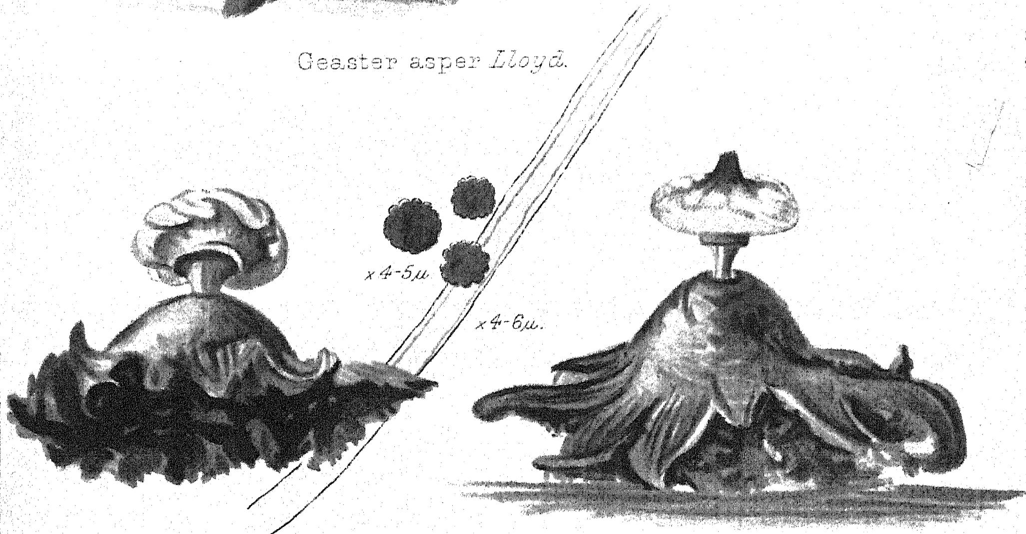
Geaster fornicatus *(Huds.) Fr.*

A. Rea del.

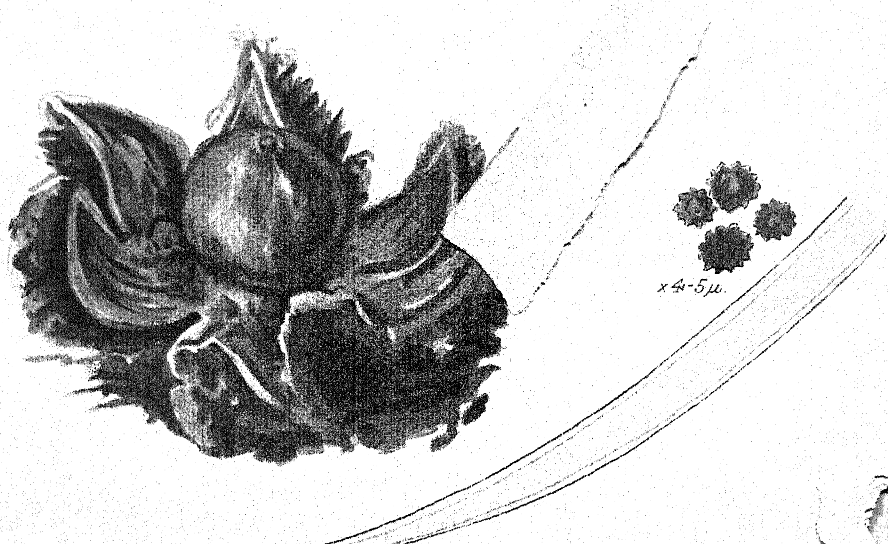
...Trans. Brit. Myc. Socy. Vol. III. Pl. 1...



Geaster asper *Lloyd.*

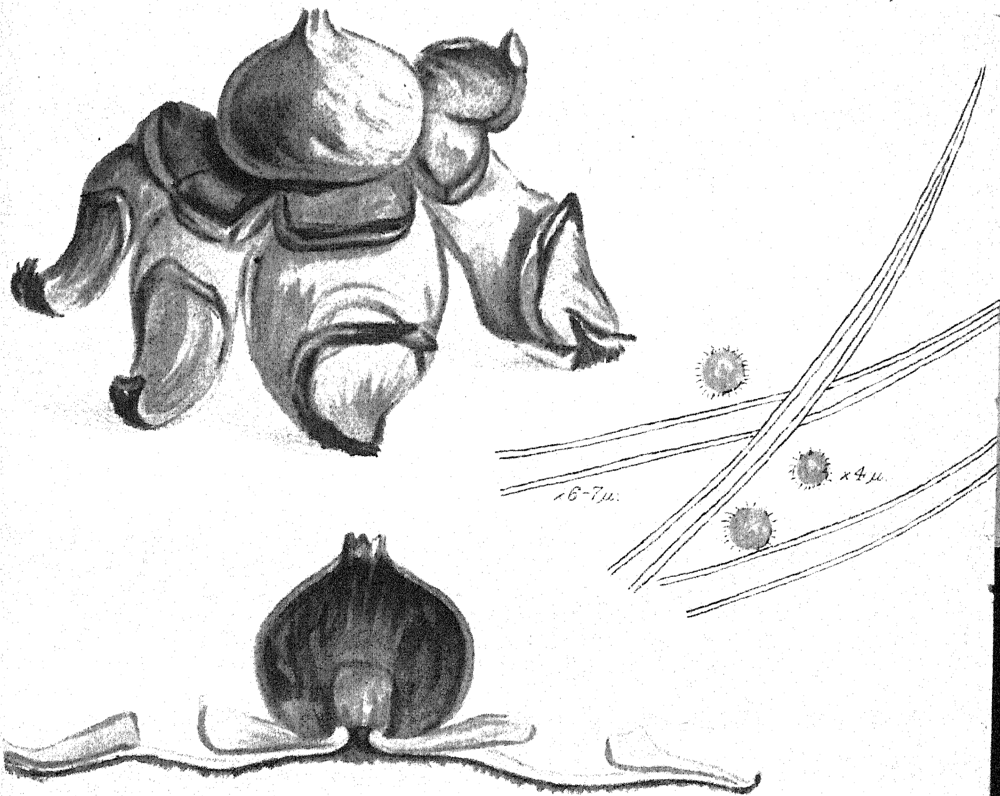


Geaster Bryantii *Berk.*

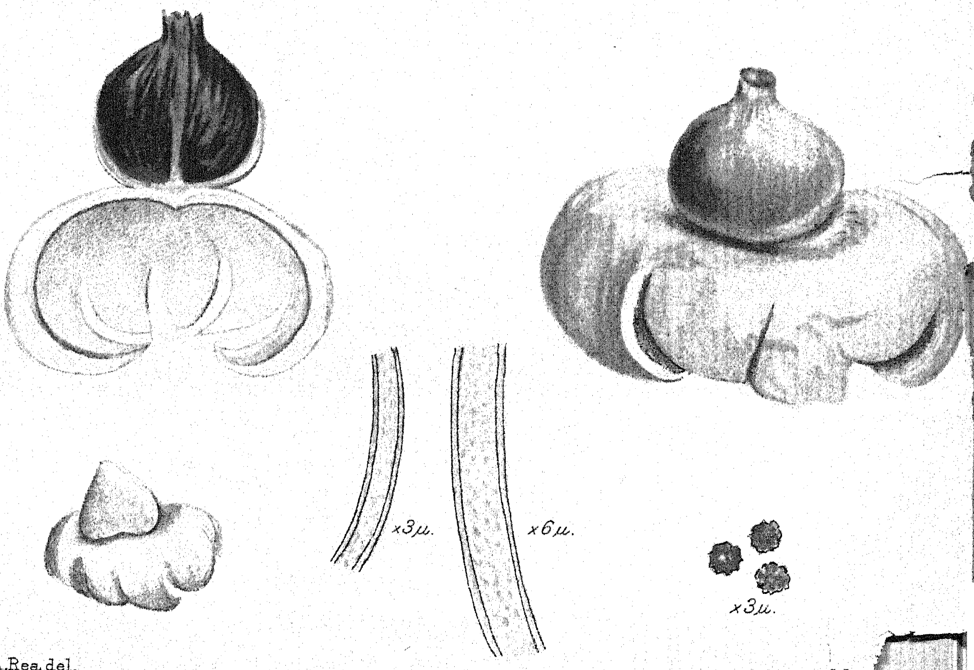


E. A. Rea del. West, N...

Geaster limbatus *Fr.*



Geaster rufescens *Pers.*



A. Rea del.

Wes

Geaster fimbriatus *Fr.*

be considered in the nature of an accidental feature and not an essential character of the plant. The distinguishing features by which the plant can be known from RUFESCENS are, *the acute (not globose) young form, the definite mouth and the elongated columella.*" The only other British Geaster that has a pedicellate endoperidium is GEASTER FORNICATUS (Huds.) Fr. (Plate 17), but this species is also well characterized by another feature which distinguishes it from all the rest. The exoperidium splits up into layers which are divided into four or five segments and these only remain attached to each other by their apices, *the outer layer forming a cup in the ground, whereas the inner layer is raised aloft, becomes convex and bears the stalked endoperidium on the apex of a hollow sphere.* This is a large species and was originally described by Hudson from English specimens in 1778. Although this species is so distinct from all the others it is remarkable that both Fries and, later still, Fischer in Engler and Prantl. Planzen Familien have confused it with GEASTER CORONATUS (Schaeff.) Schröt., which is a small fornicate Geaster that grows abundantly in the coniferous woods of the Continent and which has never been recorded for Britain. The remainder of the British Geasters have *sessile* endoperidia and amongst these we find our most common species GEASTER FIMBRIATUS Fr. (Plate 19). In this species the exoperidium is split down to the middle into a variable number of segments which are strongly revolute and bent underneath when the plant is in a good growing condition, and this is well represented in Berkeley's Outlines of British Mycology, t. xx., f. 4, but when the plant is older and worn out *the inner layer* of the exoperidium generally *separates from the outer* and disappears, leaving the outer flaccid, membranaceous layer. Lloyd says at p. 37 of The Geastrae " The idea that FIMBRIATUS can be known by its 'fimbriate' mouth is an error. The mouth does not differ from several other species with *indeterminate* mouths. I am convinced that it is practically the same plant as our GEASTER SACCATUS Fr. With the exception of the *indeterminate mouth* and the *tendency of the exoperidium to split into two layers* I can see no other difference." GEASTER SACCATUS Fr. has been recorded for Britain both by Massee in his British Fungus Flora, vol. I., p. 419 (1892) and by Worthington G. Smith in his British Basidiomycetes, p. 470 (1908). GEASTER LAGENIFORMIS Vitt. is known by its *acute apex* when the plant is unexpanded and by the *very long, acute* segments of the exoperidium when expanded which *often twist up* when dry. The last British species, GEASTER MICHELIANUS W. G. Sm., was described and named by Worthington G. Smith, but Dr. Hollos says that it is identical with the before mentioned GEASTER TRIPLEX Jungh. It is characterized by its *very rigid* exoperidium, which is *often very much cracked externally*, and its *ovate acuminate* shape when young.

WORK PUBLISHED DURING 1911 ON THE CYTOLOGY OF FUNGUS REPRODUCTION.

By J. Ramsbottom, B.A.,
Assistant, Department of Botany, British Museum.

The question of sexuality in fungi is of peculiar interest. Many points arise such as have not to be considered in the other plant groups, and there is a greater range of sexual differences in fungi than in the whole of the other plant phyla. Numerous controversies have been waged concerning the phenomena observed, and when the facts have been agreed upon there have still been great differences of opinion concerning the interpretation of these facts.

As a group, the Phycomycetes have offered the least difficulty. The majority of the old observers held that a normal process of fertilisation obtains in most of the genera, and various workers during the last twenty years, working with modern cytological methods, have confirmed that view.

A section of this group, the Saprolegniineae, however, gave great difficulty. Certain members of the family possess both oogonia and antheridia, the presence or absence of the latter often depending upon external conditions, whereas other species are always without antheridia. Pringsheim held that normal fertilisation took place in certain cases, but de Bary (and after him Humphrey, Ward, Hartog, and others) considered that the family as a whole was apogamous, i.e., that the antheridium, even where present, was never functional. Trow held that in certain species of *Achlya* he had proved normal fertilisation, but his work was not quite free from doubt until 1904, when he clearly showed that a male nucleus fused with a female nucleus in the oosphere of *Achlya de Baryanum* and *A. polyandra*. Normal fertilisation has since been shown to take place in *Saprolegnia monoica* (Claussen 1908). Mücke (1908) saw the male and female nuclei close together in *Achlya polyandra*, although he did not see actual fusion.

Kasanowsky (1911) has published an account of his researches on *Aphanomyces laevis*. In this monoecious species both oogonium and antheridium are multinucleate. In the oogonium a large central vacuole develops which, as it enlarges, forces the

protoplasm to the periphery, and many of the nuclei degenerate. Those that remain undergo a mitosis, as also do the nuclei in the antheridium. In each organ all the nuclei degenerate except one. The oosphere is formed in the middle of the oogonium by the gathering of the protoplasm towards the centre round a coenocentrum, which acts as a centre of nutrition. The female nucleus lies near the coenocentrum and increases in size. The single male nucleus passes over with some protoplasm and fuses with the female nucleus. The oospore is uninucleate.

This account is quite in accord with what has been described in the other Saprolegniineae. In all recent work the sexual organs are described as being at first multinucleate; all the nuclei degenerate except one male nucleus and one female nucleus, which fuse in the oosphere. No series has yet been found which corresponds to that discovered in the Peronosporineae, e.g., in *Albugo*, where a regular transition can be traced from multinucleate antheridium and oogonium, the nuclei of which fuse together in pairs, to a case where all degenerate except one male and one female nucleus, which then fuse. Also in the Saprolegniineae (with the exception of the anomalous *Pythium*) there is no periplasm formed as in the Peronosporineae. The only questions which seem to be debatable are (1) whether the body in the oosphere is a coenocentrum and equivalent to the similar structure found in the Peronosporineae, at least physiologically (Davis and Kasanowsky), or whether it is a centrosome with or without additional structures (Trow, Claussen and Mücke); (2) whether two mitotic divisions take place in the sexual organs, as Trow states. Trow thinks that in *Achyla de Baryanum* he has seen two divisions which constitute a true reduction division, the number of chromosomes being halved during the process. Two divisions have been observed in the sexual organs of several of the Peronosporineae, e.g., in *Albugo Bliti*, but it is not known whether this is usual, as the observers have differed in their accounts of the same species. Trow is the only one who claims to have really counted the chromosomes. It seems extremely doubtful whether the two divisions observed constitute a reduction division, as Davis (1903), working on a form of *Saprolegnia monoica*, which was without antheridia, observed a division in the oogonia.

In the Ascomycetes the controversies have been much more severe and we are yet far from having agreement with regard to the facts judging from recent publications. An interesting account of these controversies by Dr. Fraser was published in the Transactions of this Society for 1908.

In the Helvellineae Carruthers (1911) has published a paper on *Helvella crispa*. There is in this species no ascogonium, and in this respect it agrees with *H. elastica* (McCubbin 1910); but

Brown (1910) found an ascogonium in *Leotia lubrica*, although his specimens were too far advanced to work out its structure and development. The hypothecium is a loose tangle of hyphae with a variable number of nuclei in the cells. Certain of these nuclei were observed to fuse in pairs as in *Humaria rutilans* (Fraser, 1908), but there was no evidence of nuclear migration such as occurs in that species. In *H. elastica* McCubbin found a very marked difference between fertile and vegetative hyphae, the former containing several nuclei in each cell, the latter only two. In *H. crispa* Carruthers found that although in most cases the cells of the paraphyses are binucleate, while those of the fertile hyphae have a large number of nuclei, no exact differentiation can be traced between the two. The hyphae which are to give rise to the asci are generally larger than the paraphyses, and their nuclei resemble in size and appearance the fusion nuclei of the hypothecium. A certain amount of evidence was obtained as to mitosis in both the vegetative and the fertile hyphae; the number of chromosomes in the first appear to be two, and in the latter four, and then eight. "The nuclei are, however, so minute that it would be unwise to attach any great importance to these phenomena." In the divisions in the ascus brachymeiosis (a second reduction as first recorded by Fraser in *Humaria rutilans*) occurs. The first division is heterotype with four bivalent chromosomes, the second homotype with four monovalent chromosomes, and the third is brachymeiotic with two chromosomes. This latter number is confirmed by the fact that in mitosis in the spore two chromosomes go to each pole. Neither McCubbin nor Brown found a second reduction in the ascus.

In the Pezizineae, Guilliermond (1911) has criticised the work of Fraser and her pupils on the divisions in the ascus. He has worked again at *Humaria rutilans*, the species in which Fraser first recorded brachymeiosis. He had previously (1904-5) published an account of the nuclear divisions in the ascus of this species, and unfortunately did not cut fresh material for his present study, but used his old slides. *H. rutilans* has very suitable nuclei for the study of these phenomena. Gulliermond now considers that Fraser's account of the first two divisions, a heterotype, then a homotype, following the scheme Farmer and Moore formulated for the reduction divisions in both animals and plants, is probably correct, and he admits that he missed "plusiers stades" recorded by Fraser. However, he does not consider that there is a second reduction. From a study of all his figures he thinks that the number of chromosomes is certainly greater than eight in the third division, and approaches sixteen, the number present in the first and second divisions, although he could not count exactly the number because of their

length and twisting. "Comme, d'autre part, les figures de Fraser ne sont pas plus démonstratives que nos préparations (et ne peuvent l' être), nous nous permettrons donc d'émettre des doutes très sérieux sur l' exactitude de l' interpretation de cet auteur et de considérer son opinion comme une simple théorie qui aurait besoin de trouver sa demonstration."

Guilliermond also re-examined his old slides of *Peziza catinus* and *Pustularia vesiculosa*, the latter being one of the species in which Fraser and Welsford recorded brachymeiosis. In *P. catinus* he finds the first two divisions favourable to Fraser's view, but the number of chromosomes remains constant throughout the three divisions. In *P. vesiculosa* the chromosomes, being less in number and smaller than in the other species, their enumeration is much easier and allows of remarkable precision. He insists that there is no numerical reduction in the ascus, the chromosomes being eight in number throughout the three mitoses.

In *Galactinia succosa* the author did not rely on his old preparations, as the series was not complete. He had previously thought that the occurrences were as they had been recorded by Maire, which seemed to agree somewhat with Fraser's views, but he holds that his latest investigation has shown that the number of chromosomes remains constantly eight, and that the processes of division here agree absolutely with those in all the other Ascomycetes he has studied.

Brown (1911) has studied the development of the ascocarp of *Lachnea scutellata*. The archicarp, when mature, consists of a row of about nine cells, which reminds one of the scolecite described in some of the Ascobolaceae, but the cells are not apparently fused. The ascogonium is the penultimate cell of the row and it is multinucleate, as are also the vegetative cells. At no stage was an antheridium seen even when the young ascocarp consisted of only a few hyphae. It is interesting to compare this case with that of *L. stercorea* (Fraser, 1907), where there is an oval ascogonium and a septate trichogyne together with sometimes a multinucleate antheridium.

The nuclei in the ascogonium divide karyokinetically, centrosomes being present. "Five daughter chromosomes proceed to each of the opposite poles. . . . The two groups of chromosomes are usually separated far enough so that when they reorganise the daughter nuclei are separated by an appreciable distance. Frequently, however, the daughter nuclei reorganise so close together that after a slight growth they are pressed against each other and resemble fusing nuclei." The nuclei do not divide simultaneously and all stages can be found in a single ascogonium. No fusion was observed in the ascogonium. A number of cases were seen where two nuclei were pressed

against each other, but in all these cases the nuclear membranes between the nuclei were intact and there was every appearance that the two nuclei were daughter nuclei of the same nucleus which had reorganised close together. Also fusion nuclei are often simulated by the fact that during prophase, when the nuclei are large, the chomosomes sometimes mass into a nucleolus-like group. "It may be said that a fusion of the nuclei would be hard to find, but they have been looked for very carefully in a large number of well fixed and stained preparations. The slight decrease in the size of the nuclei during the development of the ascocarp and the persistence of the same number of chromosomes throughout the ascogonium and ascogenous hyphae, moreover, indicate very strongly that a fusion of nuclei during this stage is not to be expected." The first division in the ascus is heterotypic, the second and third divisions are the same as in the ascogonium. The number of chromosomes is five throughout the life history of the fungus, and there is thus, he concludes, no second reduction. The author's figures of the nuclear divisions are all text figures and it is very unfortunate that all those which have to deal with the division in the ascogonium, the critical portion of the paper, should be labelled "x 11,200."

In the Pyrenomycetineae, Winge (1911) has published a paper under the very appropriate title "Encore le *Sphaerotheca Castagnei*." De Bary (1863) was the first to find what he considered to be sexual organs in this species. Two branches put out small protuberances at the same time which rise erect; one of these is the unicellular ascogonium and the other consists of two cells, the terminal one of which is the antheridial cell. The antheridial branch is always closely applied to the ascogonium. In 1895 Harper worked at this species with modern cytological methods. He announced that the antheridium and ascogonium are both uninucleate and that the walls between the two organs break down to allow the male nucleus to pass into the ascogonium and fuse with the female cell. Dangeard (1897) denied that there was ever any open communication between the cells. Blackman and Fraser (1905), in preparing some slides for class purposes, came across stages which seemed to prove the correctness of Harper's views, and they published a short note with figures to that effect. Winge states that Dangeard's is the correct interpretation and re-states many of the latter's arguments. He criticises Harper's figures, saying that they represent the nuclei as all being globular, whereas this is only true for the male nucleus. The principal points of his paper are as follows:— The ascogonium seems to have an attraction for the antheridial branch, probably as a reminiscence of former times still emitting the substance which attracts the antheridium. No fusion has

been observed between the two cells, and they are always separated by a gelatinous layer formed by the walls of the two cells. At a certain stage two nuclei, usually of different sizes, are present in the ascogonium. The smaller nucleus has the same structure as the larger one, and it is obvious that they have arisen from the division of the original ascogonial nucleus, although, unfortunately, this division has not been seen. Very often at the stage when two nuclei are present in the ascogonium one finds the remains of the degenerated male nucleus in the antheridium, and several times a well preserved male nucleus has been found. The two nuclei in the ascogonium do not fuse. Their further divisions have not been clearly seen, but the ascogonium becomes three septate—the penultimate cell possesses two nuclei which fuse to form the primary ascus nucleus. The divisions of this fusion nucleus have not been carefully followed out, but, from the meagre account, it seems as if brachymeioses may occur, eight chromosomes being present in the first two divisons and "nous croyons avoir vu quatre chromosomes à la dernière division."! A point Winge draws attention to is the fact that while Harper and Blackman and Fraser hold that the ascogonium divides into four to six cells, Dangeard and himself always find three. He suggests that this may be because they are working at different species. In considering this suggestion, however, one must note that all obtained their specimens from the Hop with the exception of Winge, whose specimens were on Melampyrum, which means that there would be two different species on Hop, and that one of these also occurred on Melampyrum, the two being only distinguishable by cytological methods.* In spite of his suggestion, however, he holds that Dangeard and he are correct and that some of Harper's figures are surely wrong. "En effet, nous trouverons assez souvent dans les coupes au microtome, des figures correspondantes aux dessins de cet auteur, mais les explications qu'il en a données sont fausses. Naturellement, quand on coupe en différents sens une ascogone, qui est courbée, qui a trois cellules, dont celle du milieu a deux noyau, les autres un seul noyaux chacune, il est possible de voir des coupes qui, par orientation erronée, donnent des résultats fautifs—et c'est ce qui est arrivé pour Harper." Nothing is, however, said of the figures of Blackman and Fraser, who had knowledge of Dangeard's criticisms when they wrote their note.

Vallory (1911) has published a preliminary note (without figures) on the cytology of *Chaetomium Kunzeanum* var *chlorinum*. He records, as do Oltmanns and Dangeard, the presence of an ascogonium, unaccompanied by an antheridium.

* *Sphaerotheca Castagnei* var *fuliginea* occurs on Melampyrum. It is quite distinct.

This ascogonium becomes rolled up on itself and divides into portions which end by forming a mass of false tissue from the cells of which arise the ascogenous hyphae.

The mycelium produced from a germinating spore is septate and plurinucleate. The nuclei are very small and show a nucleolus without visible limiting membrane or chromatin. The nuclei are very frequently arranged in pairs, which are identical in appearance with those that Blackman and his followers have described in the ascogonia of various Ascomycetes (*Humaria granulata*, *Ascophanus carneus*), and which are considered by them as stages in the fusion of pairs of female nuclei. As regards the mycelium, it cannot be a case of nuclear fusions, and the only plausible interpretation is that the pairs of nuclei are the different stages of amitoses where the daughter nuclei are more or less separated. This, states Vallory, is shown by the following facts. The pairs are present in the young actively growing mycelium, where the nuclei multiply abundantly: that no other nuclear phenomenon has been observed, which can explain this multiplication: that there is a lesser number or complete absence of pairs of nuclei in the older parts of the mycelium: that they re-appear on the contrary in the investing rapidly growing hyphae which arise on this old mycelium: that they are present in the wall of the perithecium already well developed. Pairs of nuclei identical in appearance are found in the young ascogonium and in the various cells produced by the septation of the ascogonium. These pairs of nuclei are not stages of fusion but stages of division. The further study of the nuclei of the ascogenous hyphae and of the asci has not yet been carried out. This further work will be awaited with interest.

Though Brown and Vallory agree in considering the pairs of nuclei in various ascogonia as division-stages, the former considers the division to be karyokinetic, the latter amitotic.

It is a noteworthy fact that in no case where this fusion of female nuclei in pairs has been recorded has there been described a nuclear division in the ascogonium, although the nuclei increase greatly in number, e.g., *Ascobolus furfuraceus* has been described as having, when first formed, only one nucleus in the ascogonium.

In *Humaria granulata* (Blackman and Fraser, 1906) the nuclei, which are rather small, show no nuclear network but exhibit a nuclear membrane and a single deeply staining nucleolus. "As development proceeds the nuclei increase only slightly in size but enormously in number . . . . female nuclei were observed fusing in pairs in the ascogonium. These fusions are to be observed in ascogonia of various ages. . . . No data were obtained as to the number of nuclei in the ascogonium at its first inception, but judging from the size of the organ at that

stage and from the relatively small number of nuclei in the vegetative cells, very numerous divisions must take place. It is curious that such divisions were never observed in the ascogonium; it is probable that they are intermittent in occurrence; possibly they take place only at night." It is obvious from these extracts that the authors must have considered the case for nuclear division and decided against it.

In the Laboulbeniaceae (considered by Thaxter and Faull as belonging to the Pyrenomycetineae) Faull (1911) has published an introductory account of the cytology of the group. The female organ (procarp) consists of three distinct parts. The uppermost portion is the trichogyne and may be unicellular or more complicated in structure; the middle portion is in all cases unicellular and uninucleate, and is termed the trichophoric cell; the lowest portion, unicellular and uninucleate, is termed the carpogonium, being the portion of the procarp which is fertilised. Except in the case of *Laboulbenia chaetophora*, the author is uncertain as to the origin of the pair of nuclei which appear later in the carpogenic cell. This species is interesting because of the lack of antheridia or of any organs that might function as antheridia. The nucleus of the carpogonium divides and the lower of the two daughter nuclei is cut off to form the inferior supporting cell. The nucleus in the trichophoric cell also divides, the septum between the trichophoric cell and the carpogonium temporarily disappears and one of the daughter nuclei passes into the carpogonium, after which a septum reappears. The pair of nuclei in the carpogonic cell now undergo division. A transverse wall separates the carpogonium into a binucleate ascogonium and a binucleate superior supporting cell. Presumably the nuclei in the ascogonium again divide, to supply a secondary inferior supporting cell which is cut off from the lower end of the ascogonium. The binucleate ascogonium now usually divides by a nearly vertical wall into a pair of binucleate ascogenic cells, but may at once begin to bud off asci. At the beginning of each ascus this pair of nuclei divide simultaneously and mitotically and a daughter of each passes into the young ascus, where they fuse. The fusion nucleus enters on a long period of growth, finally undergoing three successive mitoses. "The first exhibits clearly the phenomena said to be characteristic of meiosis, except that neither here nor in the two subsequent divisions is there any change in the number of chromosomes." Spore formation occurs in the same manner as in the ordinary Ascomycetes. Speaking generally of the Laboulbeniaceae, Faull finds that the cells of the thallus are typically uninucleate and that the nuclei divide mitotically. The spermatia in all the forms studied are uninucleate. Spermatia have been seen attached to trichogynes, but

their entrance into, or fusion with them has not been demonstrated, nor has the nucleus been detected migrating down the trichophoric cell although the carpogenic cells become binucleate in every case studied, as are the ascogenic cells. No evidence of a nuclear fusion in the carpogenic cell or in the ascogonium has been seen, "though the possibility of the occurrence of such a fusion is not precluded." As pointed out by Faull, the phenomenon of conjugate nuclear division and in *L. chaetophora* of a reduced type of sexuality suggest similar phenomena in the rusts and certain Ascomycetes. Also the "uninucleate antheridium, the possibility of proliferation of spermatia from the same antheridium, and the exogenous type of spermatium organization, suggest similar phenomena in the rusts, many Ascomycetes and the Florideae." It is rather unfortunate in many ways that a form without spermatia should have first received a cytological description instead of one of the species in which Thaxter states that he has observed spermatia fused with the trichogynes. When work is done on some of these latter it will be possible to see how far the nuclear occurrences in *L. chaetophora* are normal, and whether the nucleus which migrates from the trichophoric cell is to be regarded as a vegetative nucleus and thus comparable with the migrating nucleus described in *Phragmidium violaceum*.

In the Uredineae the nuclear phenomena seem now to be fairly well known. By the work of various investigators, especially of Sappin-Trouffy, it was clearly shown that a binucleate condition alternates with a uninucleate one. The binucleate cells arise at the base of the aecidium. The nuclei divide conjugately. The vegetative and reproductive cells in the stages of the life cycle that follow are all binucleate. Fusion between the two nuclei finally takes place in the mature teleutospore. The teleutospore germinates and produces a promycelium which bears uninucleate sporidia, giving rise to a uninucleate mycelium. The process by which the uninucleate cell became binucleate was first described by Blackman *(Phragmidium violaceum 1904)*. He found that in the young aecidia the uninucleate hyphae were arranged in parallel series, the penultimate cell becoming binucleate by the migration into it of the nucleus from a subadjacent cell. Christman (1905) showed that in *P. speciosum* the binucleate condition arose by the breaking down of the longitudinal wall between two adjacent penultimate cells. Further work seems to show that the method described by Christman is much the more frequent, some investigators even holding that where migration takes place as described by Blackman it is purely a pathological effect.

Maire (1911), in an interesting paper on the biology of the Uredineae, incidentally mentions that on re-examining his slides

of *Puccinia Bunii* he has found that the synkaryon seems to arise by Christman's method, but the cells are so intricate that it is very difficult to distinguish details.

Several species with an incomplete life cycle have been investigated, but the most interesting case is that of the genus *Endophyllum*, in which there are no teleutospores. The aecidiospores germinate, producing directly a promycelium with four sporidia. Hoffmann (1911) has worked at a species of this aberrant genus, *E. Sempervivi*. Maire (1900) had previously investigated this species as well as *E. Valerianae-tuberosae*, while Sappin-Trouffy (1896) had worked at *E. Euphorbiae-silvaticae*. In the first and last of these species the process described was identical. Binucleate aecidia are formed. These germinate, the nuclei dividing to form the four nuclei of the promycelial cells. The nuclei pass into the sporidia and there divide previous to germination. In *E. Valerianae-tuberosae* the account given is different. One of the nuclei in the aecidiospore degenerates and disappears. The other nucleus passes into the very short promycelium on germination and there divides, and between the two daughter nuclei a wall is formed. The nucleus of the lower cell either degenerates at once or divides, both daughter nuclei then degenerating. The nucleus of the remaining cell passes into the single sporidium. These accounts could not be fitted in at all satisfactorily with what is known to occur in so many of the other genera. Hoffmann's account, however, shows that in the case of *E. Sempervivi* at least the phenomena are not so anomalous as they have been described. A binucleate basal cell arises in the young aecidium by Christman's method. The two nuclei divide in the well-known conjugate manner, and cut off alternately binucleate aecidiospores and binucleate intercalary cells. In the aecidiospore the two nuclei fuse. The fusion nucleus undergoes reduction either in the spore or in the promycelium which arises from it. The promycelium has generally four uninucleate cells, from each of which a uninucleate sporidium arises. The sporidium on germination gives rise to a uninucleate mycelium which produces spermatia (of which the fate is unknown) and the aecidia. There is thus a well marked alternation of generations, but the sporophyte is considerably reduced. An interesting case where apparently there is not a binucleate sporophytic stage has been studied by Moreau (1911). Working at an aecidium parasitic on Euphorbia silvatica, she found that a binucleate condition was never present. The single nucleus of the basal cells divides and a wall is formed between the two daughter nuclei. The upper uninucleate cell is the aecidiospore mother cell. The lower uninucleate cell continues to form aecidiospore mother cells by division. The nucleus of each mother cell divides into two and

a wall is formed between the daughter nuclei: the upper larger uninucleate cell is the aecidiospore which grows, ripens and detaches itself; the lower smaller cell is an intercalary cell which later disappears. Moreau was unable to germinate the aecidiospores and therefore could not determine whether she was working with *Endophyllum* or not. Plowright (Brit. Ured., p. 229) however, speaking of *E. euphorbiae* says:—"The spores of this species germinate freely in water." Whatever the genus, the point of interest is that this is the first record of parthenogenetically formed aecidiospores.

In the Basidiomycetes Kniep (1911) has given an account of results obtained in cultures of *Armillaria mellea*. He obtained a uninucleate mycelium by sowing various parts of the fungus. On this mycelium arose out-growths which, from their structure and appearance, were obviously basidia. There was present in these basidia a single nucleus which increased in size, this increase not being due to a fusion of two nuclei, all possibilities of such being the case having been carefully considered. This large nucleus underwent two successive divisions which were identical in all their stages with the two divisions which occur in normal basidia and are generally supposed to constitute reduction divisions. It is interesting to note in this connection the occurrence of uninucleate basidia arising from a series of uninucleate cells in *Hygrocybe (Hygrophorus) conica* and *H. ceracea* investigated by Maire (1902). The work of several authors has shown that in the majority of cases the young basidium is binucleate. The two nuclei fuse later, the fusion nucleus increases in size and undergoes two successive divisions which together constitute reduction, the four resulting nuclei passing into the spores. In these two species, however (placed by Maire in a new genus *Godfrinia*) the basidia bear only two spores, the nuclei of the latter arising by simple mitosis from the uninucleate basidium.

Fries (1911) has published a continuation of his work on the development of *Nidularia*. He finds that as is usual, the young basidia are binucleate. The two nuclei become larger before fusion. The fusion nucleus rapidly increases in size and then undergoes two successive divisions, the details of which were hard to make out, but the author considers that in the first division two bivalent and in the second division two monovalent chromosomes are present. The nuclei after the second division pass into the spores through the sterigmata. They are at this stage in the prophase of a division which is completed in the spore. The spore is therefore binucleate as in all the Gasteromycetes. The spindle in the first nuclear division in the basidium is at right angles to the longitudinal axis (Chiastobasidiae of Juel). Maire (1902) has described very similar happenings in *Nidularia globosa* and *Cyathus hirsutus*.

In most Basidiomycetes studied the basidium arises from a series of binucleate cells. It is not yet known how this binucleate condition arises, nor at what stage of the life history. It is therefore not yet possible to relate the nuclear phenomena to what occurs in the Uredineae and to what Claussen has described in the Ascomycetes.

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NEW OR RARE MICROFUNGI.

By A. Lorrain Smith, F.L.S.

The Fungi recorded in the accompanying lists were nearly all collected and many of them determined by Mr. D. A. Boyd, to whose researches we owe so many of the recent additions to our micro-fungus flora. In the work of verifying the species and arranging the list, I have been helped throughout by Mr. J. Ramsbottom. The diagnoses of the species found by Mr. W. B. Grove are mostly published in the Journal of Botany and it has been considered unnecessary to re-write them. Mr. Grove has also published two pages of illustrations.

DISCOMYCETES.

TAPHRIDIUM Lagerh. & Juel in Bih. Svensk. Vet. Akad. Afd. 3, No. 16, XXVII., pp. 1-29, 1 pl. & figs.

Fertile hyphae creeping under the epidermis of the upper surface of the leaf forming at length an almost continuous stratum similar to *Taphrina*. Sporangia globose, or shortly ellipsoid, with a membrane somewhat thick but not hardened; spores numerous, ovoid, ejected at once.

Genus akin to *Protomyces* from the intercalary formation of the sporangia.

T. umbelliferarum (Rostr.) Lagerh & Juel Tom. cit. p. 8, 5 figs.

Mature sporangia with a thickish double membrane, the middle layer deliquescing; the outer layer bursting, the spores still enclosed in the inner sac protruding. Sporangia $45\text{-}75\mu \times 30\text{-}60\mu$; spores $2\text{-}7\mu \times 1\text{-}4\mu$.

On *Heracleum Sphondylium*. Collected by Mr. D. A. Boyd at Roseneath, Dumbartonshire, June, 1908.

PYRENOMYCETES.

Podosphaera myrtillina Kunze.

This species has been found by Mr. D. A. Boyd on leaves of *Vaccinium Myrtillus* at Currie Glen, Borthwick, Midlothian. Previously it had been recorded only from the North of Scotland.

Didymella? hyporrhodia Sacc. in Michelia II., p. 316 (1880).

On stalks of *Umbelliferae*, Murlough Bay, Ireland.
W. B. Grove in Irish Naturalist XX. p. 142 (1911).

SPHAEROPSIDEAE.

Phoma complanata Desm. ex Sacc. in Michelia II., p. 337 (1880).

On dead stems of Umbellifers, Glenariff, &c., Ireland. W. B. Grove in Irish Naturalist XX. p. 142 (1911).

P. urticae Shulz & Sacc. in Sacc. Syll. Fung. III., p. 140 (1884).

On Nettle, Cushendall, Ireland.
W. B. Grove l.c.

Phoma pigmentivora Mass. in Roy. Bot. Gard., Kew Bull., 1911, p. 326, 1 pl.

Forming suborbicular determinate spots, about 1-8 cm. in diameter, bright rose or rose purple in colour. Perithecia scattered or gregarious, scarcely prominent, purplish black, minute, subglobose; texture parenchymatous, ostiole subpapillate. Spores ellipsoid, colourless 4-6μ long, 2-2·5μ thick.

On fresh paint, which it destroys. Found on greenhouses, &c.

Phyllosticta Mahoniana Sacc. (see p. 118).

Two specimens have been sent by Mr. D. A. Boyd, one from Cumlodden, Minigaff, Kirkcudbrightshire, the other from Galston, Ayrshire. They have the perithecia of a *Phyllosticta* but no spores. There seems little doubt, however, that they belong to the above species.

Oospora hyalinula Sacc. Syll. Fung. IV. p .17 (1886).

On dead Ash branches, Studley Castle, March.
W. B. Grove in Journ. Bot., L. p. 11 (1912).

O. ochracea Sacc. Syll. Fung. IV., p. 23 (1886).

On remnants of extract of malt in bottle, Lower Edmonton.
W. B. Grove l.c.

Monilia lupuli Mass. ex Grove in Journ. Econ. Biol. VI., pp. 38-49, 2 pls. (1911).

Forming an effused farinaceous stratum of a fine pinkish-salmon colour. Conidiophores up to 1 mm. high, erect, slender, septate, branched above; branches rather divaricate; chains of spores also branched in the same manner. Diameter of hyphae about 5μ; conidia roundish or oval, nearly hyaline (singly), $7\text{-}9 \times 4\mu$.

On spent hops, &c., Birmingham.

Penicillium ovoideum Preuss Fung. Hoy. n. 272; Sacc. Syll. Fung. IV., p. 81 (1886).

On size, Lower Edmonton, coll. Mr. James Scott.
W. B. Grove in Journ. Bot. L. p. 12 (1912).

Sporotrichum lanatum Wallr. Fl. Cr. II., p. 276 (1833).

Hyphae branched, intricate, whitish, sparsely septate, occurring in loose pulvinate tufts; conidia globose, minute numerous. Naturalist 1911, p. 405. Collected by Mr. J. Johnson in polluted water, Thornhill, Yorks.

S. chrysospermum Harz. Hyphomy. p. 19; Sacc. op. cit. p. 104.

On a dead stick, Sutton Park, Warwickshire.
W. B. Grove l.c.

S. terricolum Grove. Tom. cit. p. 13.

On clay soil, Randan Woods, Worcestershire, Sept.

Botrytis isabellina Preuss. ex Sacc. Syll. Fung. IV., p. 121 (1886).

On bark of Pine, Boston, Lincolnshire, collected by Sir Henry Hawley, March.
W. B. Grove l.c.

B. violacea Grove l.c.

On damp rotten wood, Studley Castle, Nov.

Ovularia Doronici Sacc. in Michelia II., p. 638 (1882).

Spots developed on the under surface, effuse, whitish. Conidiophores subfasciculate, $30\text{-}40\mu \times 3\mu$, continuous, hyaline shortly branched above or denticulate; conidia oblong or subfusiform, sometimes in chains, acute at both ends, $12\text{-}15\mu \times 4\text{-}5\mu$. On the under surface of the leaves of *Doronicum Pardalianches*. Collected by Mr. D. A. Boyd at Largs, Ayrshire, in August, 1911, and at Moffat, Dumfriesshire, and Hopetoun, Linlithgowshire, in Sept., 1911.

O. primulana Karst. Frag. Mycol. in Hedwigia XXIII., p. 7 (1884).

On leaves of Primrose and Cowslip, Studley and Spernel, July, Aug.
W. B. Grove in Journ. Bot. L. p. 13 (1912).

Ramularia aromatica Von Höhnel in Oesterr. Bot. Zeitschr. LV. p. 23 (1905). *Septocylindrium* Sacc. in Michelia II., p. 639 (1882).

Leaf-spots on both surfaces, elongate, 1-1½ cm. long, and up to about 1 cm. wide though usually narrower, looking as if burnt. Conidiophores fasciculate, emerging from the stomata, very short, about 20μ long, and 3μ wide, colourless. Conidia in chains, rod-like, rather pointed at the ends, 20-75μ × 2-3μ, simple, becoming 2-4 septate, with very delicate septa.

On decaying leaves of *Acorus Calamus*.

Collected at Perreton, Ayrshire, by Mr. D. A. Boyd, Sept., 1911.

R. Centaureae Lindr. in Ach. Soc. Faun. Flor. Fenn. XXII. No. 3, p. 7 (1902).

Spots small, 1-5 mm. wide, limited by the veins of the leaf, whitish, surrounded by a dirty-brown line, on both sides of the leaf; conidiophores in tufts, bursting through the stomata, at first unbranched, 1-3-dentate above, 28-58μ × 3-6μ, becoming branched and longer up to 90μ with several septa; conidia cylindrical, single or in short chains, usually 2-celled, rarely simple or 2-septate, often somewhat constricted in the middle, 30-40μ × 3-6μ.

On *Centaurea*. Collected by Mr. D. A. Boyd on *C. nigra*, West Kilbride, Ayrshire, Sept., 1910.

R. geranii Fuck. Symb. Myc. p. 361, t. 1, fig. 23 (1869).

Leaf spots roundish or angular, limited by the veins, ochre coloured to brown or brownish-black, remaining small or coalescing and occupying whole segments of the leaf, or spreading from the point of the leaf-segments. Conidiophores emerging in fascicles from the stomata on the under side of the leaf and forming a whitish powdery layer, unbranched, usually non-septate, straight or bent, denticulate at the tips, colourless or yellowish, brownish at the base; conidia cylindrical, blunt or somewhat tapering at the ends, simple or 1-2-septate, straight or slightly bent, colourless or faintly yellow, 18-40μ long, 2·5-5·5μ thick.

On the leaves of various species of *Geranium* and *Erodium*. Collected by Mr. D. A. Boyd on leaves of *Geranium sanguineum* at Portincross, Ayrshire, Aug., 1911. Already recorded for Great Britain (Massee Brit. Fung. Fl. III. p. 345 (1893)).

R. heraclei Sacc. Fungi. Ital. t. 1008 (1881) and Syll. IV., p. 206 (*Cylindrosporium* Oudem. in Arch. Neerl. VII., p. 383 (1873)).

Leaf spots on both surfaces, roundish-angular, whitish with an indefinite brown margin, 2-4 mm. across. Conidiophores single or in fascicles emerging from the stomata of the leaf, slender, rarely branched, septate, rather knobby, 50-90μ long, 2-3μ thick; conidia elongate, 1-septate, 22μ long, 7μ thick, or cylindrical fusiform, pointed at the base, 3-septate and 25-30μ long, 3-5·5μ thick.

On leaves of *Heracleum Sphondylium*. Collected by Mr. D. A. Boyd at West Kilbride, Ayrshire, Aug., 1911.

The spores in the specimen from Kilbride are 1-septate, about 10-22μ long, and about 3-4μ thick. They do not agree exactly with either of the sizes given above, but possibly they are immature.

R. Knautiae Bub. in Oesterr. Bot. Zeitschr. LIII., p. 50 (1903).

Leaf spots on both sides of the leaf, small, roundish, dark violet on the upper side. Conidiophores emerging in fascicles, unbranched, denticulate at the tips, 20-35μ long, 3μ thick; conidia cylindrical fusiform, in chains, simple or becoming 1-septate, 10-20μ long, 2·5-4μ thick.

On leaves of *Knautia*, &c. Collected by Mr. D. A. Boyd on leaves of *Scabiosa Succisa* at Bridge of Allan, Stirlingshire, and at West Kilbride, Ayrshire.

First described by Massalongo as a variety of *R. Succisae;* it differs from that species in the much darker leaf spots and the smaller spores.

R. lamiicola Massal. in Bot. Centralbl. XLII., p. 386 (1890).

Spots on the leaves angular, circumscribed by the nerves, rather large, brownish or reddish, at last coalescing. Conidiophores fasciculate, bursting out from the stomata of the lower surface and forming a somewhat powdery, white layer, septate, usually unbranched, dentate above, 25-30μ long, 2·5-4μ thick. Conidia of various form, shortly oval, ellipsoid, or somewhat cylindrical-fusiform, rounded at the ends, in chains, simple or rarely 1-septate, 18-20$\mu \times$ 3-5μ.

On leaves of *Lamium*. Collected by Mr. D. A. Boyd on *Lamium album*, at Crieff, Perthshire, Sept., 1910.

R. macrospora Fres. Beiträge III., p. 88, t. 11, figs. 29-32 (1863).

Spots irregular up to 20 mm. long, becoming brown. Tufts on the under surface, white or brownish, breaking through the stomata, conidiophores straight or bent, notched, simple, unbranched, somewhat swollen below, 20-60$\mu \times$ 3-7μ; conidia cylindrical, rounded at the ends, simple or 1-2-septate, sometimes slightly constricted in the middle, 20-38$\mu \times$ 4-7μ.

On *Campanula*. Collected by Mr. D. A. Boyd on *C. persicifolia* at Largs, Ayrshire, July, 1911, and by Mr. E. Ballard at Malvern, Dec., 1911 (Comm. Mr. F. J. Chittenden).

R. senecionis Sacc. Syll. IV., p. 210. *Ovularia senecionis* Massee Fungus Flora III., p. 321. On *Senecio vulgaris*.

Collected by Mr. D. A. Boyd on *Senecio aquaticus*, West Kilbride, Ayrshire, Sept., 1910.

R. montana Speg. in Mich. II., p. 169 (1880). *R. Epilobii* (Schneid.) Trail in Scot. Nat. New Series IV., p. 74 (1889).

On *Epilobium montanum*. Collected by Mr. D. A. Boyd at Eglington, Ayrshire, Sept., 1911. Previously collected by Prof. Trail on various species of *Epilobium* in Aberdeenshire, Montrose, and in Orkney.

The name *R. montana* has priority. The species was recognised correctly by Prof. Trail, but the name *R. Epilobii* was given by him as being possibly the first.

R. plantaginea Sacc. & Berl. in Atti. Ist. Venet Ser. 6, III., p. 735 (1885).

Spots indistinct, determinate, roundish, often confluent, brownish, becoming dry. Tufts on the under surface of the leaves, white, loose; conidiophores in groups bursting through the stomata, rod-shaped, simple, unbranched, tapering upwards, colourless, $30\text{-}33\mu \times 3\text{-}6\mu$; conidia cylindrical, rounded at the ends or somewhat pointed below, straight, 1-3-septate, colourless, $17\text{-}35\mu \times 4\text{-}6\mu$.

On *Plantago lanceolata*. Collected by Mr. D. A. Boyd at Crieff, Perthshire, Sept., 1910.

R. plantaginis Ellis & Mart. in Americ. Nat., p. 1003 (1882).

Leaf-spots roundish, 1-3 mm. across, rarely larger and irregular, at first greyish-green, becoming white and falling out, the edge brownish-purple. Conidiophores fasciculate, emerging from the stomata in tufts, simple usually unbranched, blunt or pointed at the tips, $30\text{-}40\mu$ long, about $3{\cdot}5\mu$ thick; conidia cylindrical or elongate-ellipsoid, straight, blunt at the ends, simple or 1-2-septate, colourless, $15\text{-}38\mu$ long, $4\text{-}4{\cdot}5\mu$ thick.

On *Plantago major*. Collected by Mr. D. A. Boyd at Lochwinnoch, Renfrewshire, Sept., 1911.

R. Primulae Thüm. in Oesterr. Bot. Zeitschr., p. 147 (1878).

On leaves of Primrose and Cowslip, Olton, Bewdley, Worcestershire. W. B. Grove in Journ. Bot. L., p. 15 (1912).

R. sambucina Sacc. Fungi ital. t. 989 (1881) & Michelia II., p. 551 (1882).

Spots on both sides of the leaves, small, brownish becoming pale; conidiophores in tufts, bursting through the stomata, short, simple, sparsely notched, colourless, $20\text{-}25\mu \times 3\text{-}4\mu$; conidia cylindrical, fusiform, occurring in chains, mostly 1-septate, colourless, $25\text{-}35\mu \times 4\text{-}5\mu$.

On *Sambucus* sp. Collected by Mr. D. A. Boyd on *S. nigra* at Abercairny, Perthshire, Sept., 1910.

R. scrophulariae Fautr. & Roum. in Rev. Mycol. XIII., p. 81 (1891).

Leaf-spots roundish, 1-5 mm. in diam., dark-purple-brown, becoming white in the centre, drying up and falling out. Conidiophores emerging in sparse fascicles from the stomata of the under surface and forming a scattered white layer; mostly simple, scarcely denticulate, rounded above, colourless, $15\text{-}30\mu$ long, $2\text{-}3\mu$ thick; conidia cylindrical, pointed at both ends, usually 1-septate, colourless, $6\text{-}20\mu$ long, $3\text{-}4\mu$ thick.

On *Scrophularia nodosa.* Collected by Mr. D. A. Boyd at Dundonald, Ayrshire, Sept., 1911.

Lindau states that he found the spores measured $18\text{-}24\mu \times 2{\cdot}5\text{-}3\mu$, and he suggests that the smaller recorded size may be owing to an early stage of development. The spores in the Ayrshire specimen agree with the smaller measurements.

R. Taraxaci Karst., in Hedwigia XXIII., p. 7 (1884).

Spots on both sides of the leaves, rounded, whitish, at first green then dirty brown, often slightly blistered, often with a purple rim; conidiophores in tufts bursting through the stomata, branched, simple, with a few notches, colourless, $30\text{-}45\mu \times 2\text{-}3\mu$; conidia rod-shaped, straight, simple or 1-septate, colourless, $11\text{-}35\mu$ (usually $20\text{-}26\mu$) $\times 2\text{-}4\mu$.

On living leaves of *Taraxacum officinale.* Collected by Mr. D. A. Boyd at Largs, Ayrshire, and Carradale, Cantyre, Argyllshire, July, 1911, and at Crieff, Perthshire, Sept., 1910. Already recorded from E. Scotland by Prof. Trail, and also collected recently at Selly Oak, Worcestershire, by Mr. W. B. Grove.

TRINACRIUM Riess. in Fres. Beitr. p. 42 (1850-1863).

T. subtile Riess. l.c.

On the hymenium of *Peniophora rosea*, Eardisland, Herefordshire, Aug.

W. B. Grove in Journ. Bot. L. p. 15 (1912).

Fusoma tenue Grove Tom. cit. p. 16.

On dead branches of *Angelica*, Alvechurch, Worcestershire, June.

TRIDENTARIA Preuss. in Linnaea 1852, p. 74.

T. setigera Grove l.c.

On dead leaves of *Angelica sylvestris*, Alvechurch, Worcestershire.

Hormiscium callisporum Grove l.c. (*Torula? callispora* Speg.).

On stems of an Umbellifer, Longdon Green, Staffs., Sept.

Periconia Desmazieri Bon. Handb. p. 113 (1851).

On stems of *Heracleum*, Bradnock's Marsh, Warwickshire, October.

W. B. Grove Tom. cit. p. 17.

Zygodesmus fulvus Sacc. in Michelia II. p. 147 (1880).

On rotten wood, Selby, Yorks. Mr. C. Crossland, November.

W. B. Grove Tom. cit. p. 18.

Hormodendron cladosporoides Sacc. in Michelia II. p. 148 (1880).

On the cut surface of a vine stem, Bulkington, Warwick.

W. B. Grove l.c.

Cercospora Ii Trail in Scot. Nat. New Series IV., p. 75 (1889).

On leaves of *Viola palustris*. Collected by Mr. D. A. Boyd at Eglinton, Ayrshire, Sept., 1911. Previously collected by Prof. Trail at Dalmally and near Inverary.

Stysanus cybosporus D. Sacc. in Staz. Sperim. Ital. XXXI. 1904, p. 80.

Coremia congregate, 1·2-1·3 mm. high, grey-green, seldom collapsing, wider above 0·8-1·5 mm. in diameter. Stalk upright, occasionally twisted, stiff, green, 300-500μ high, 150-200μ thick, composed of branched, septate olive-green hyphae, terminating in long conidial chains. Conidia for a long time dice shaped, remaining in chains, at first with a thick oil-drop, at last globose, hyaline, granular within, 6-8μ in diameter.

On decaying leaf stalks of *Fragaria vesca*, Rome.

On herbaceous stalks, collected by Mr. W. B. Grove, Birmingham, July, 1911.

BASIDIOMYCETES.

Exobasidium japonicum Shirai in Bot. Mag. Tokyo 1896, p. 52.

Galls caused by the fungus large, irregular in outline, up to 3 cm. in diameter on the leaves or terminal buds of the shoots, fleshy, greenish smooth becoming reddish and then white. Hymenium subcuticular, basidia usually with 4 sterigmata; spores oblong-reniform, $14{\cdot}5\mu \times 4\mu$.

The fungus causes hypertrophy of the leaf and destroys the buds where these are attacked.

Hab. On *Rhododendron indicum (Azalea indica)*, Hythe, Kent; also reported from the Continent and from Cornwall. Sent by Mr. F. J. Chittenden, Wisley.

USTILAGINEAE.

Tilletia Menieri Har. & Pat. in Bull. Soc. Mycol. France XX. (1904), p. 61.

Sori ashy-brown, filling the ovary; spores pallid-rusty, globose, 20-24μ in diam., areolate, the epispore about 4μ thick and furnished with tubercles.

In the ovaries of *Phalaris arundinacea*, Loch Portmore, Antrim. Coll. by Prof. Gwynne Vaughan, Aug., 1911. Comm. by Mr. W. B. Grove.

MONOGRAPH OF MYCETOZOA.—NEW EDITION.

The members of the British Mycological Society interested in Mycetozoa will be glad to learn that the new edition of the Lister Monograph is now published. The first edition, issued in 1894, has been exhausted for some time, and a second was urgently called for. Since the lamented death of Mr. Arthur Lister, the preparation of the volume has devolved upon Miss Gulielma Lister, who, we rejoice to know, is President of the Mycological Society for the current year. She is to be congratulated on the completion of her long and arduous task of re-casting and practically re-writing the whole book. New rules of nomenclature have necessitated many unavoidable changes, not only in the names, but in the synonymy. Many new genera and species, discovered since the publication of the first edition, have been added. The 224 pages of the earlier book have increased to 302 pages in the new volume. Illustrations of the new Mycetozoa have been prepared by Miss Lister, and many of the old black and white plates have been replaced by new colour drawings, which have been successfully reproduced. The whole forms a beautiful and complete text-book of these fascinating organisms, which—be they plant or animal—have been included by our mycologists as a branch of their special study.

NEW AND RARE BRITISH FUNGI.

By Carleton Rea, B.C.L., M.A., &c.

With Plate 20.

Tricholoma carneolum Fr. Icon. t. 40, f. 3, Hym. Eur. 65.

Amongst short grass, Mulgrave Woods. Naturalist (1909) 179.

Omphalia bibula Quél. Fl. Myc. 201, sub Omphalina. (=*Hygrophorus Wynniae* Berk.).

Mulgrave Woods. Naturalist (1911) 165.

Pluteus cervinus (Schaeff.) Fr. var. *rigens* (Pers.) Fr. Pers. Syn. 357. Fr. Hym. Eur. 186.

Castle Howard. Naturalist (1911) 165.

Clitopilus angustus (Pers.) Fr. Hym. Eur. 200. Icon. t. 96, f. 3.

Mulgrave Woods. Naturalist (1911) 165.

Nolanea minuta Karst. Rysslands, Finlands och den Skandinaviska Halföns Hatts-vampar (1879).

On bank of peaty ditch, Arncliffe, near Osmotherley. Naturalist (1909) 179.

Inocybe commixta Bres. Fung. Trid. I. 53, t. 58, f. 2, *I. infida* (Peck) Massee Monogr. Inocybe, 467.

Mulgrave Woods. Naturalist (1909) 179.

Inocybe Cookei Bres. Fung. Trid. 17 t, 121.

Mulgrave Woods. Naturalist (1911) 165.

Hypholoma melantinum Fr. Monogr. I., 425. Hym. Eur. 294.

Mulgrave Woods. Naturalist (1911) 165.

Lactarius tabidus Fr. Hym. Eur. 438. Icon. t. 171, f. 3. Icon. Boud. t. I., pl. 57.

Mulgrave Woods. Naturalist (1911) 166.

Boletus nigrescens Roze. & Rich. t. 60, f. 5-9, and see pl. 20.

Pileus 4-12 cm. wide, *yellowish, tomentose, fleshy,* convex, cracking with age. Stem 6-11 cm. long, 2-4 cm. thick, yellowish, striate, dotted with gray scales, ventricose, attenuated at both ends. Flesh yellowish white *becoming red on exposure to the air and finally dark brown.* Pores small ·5 mm. across, round or oblong, unequal, white soon becoming *bright yellow.* Spores olivaceous, fusiform, one to three guttulate, 12-16 × 5-6μ.

Near the Great Bog, Wyre Forest, Worcestershire, 25th July, 1911, and Wyre Forest, Shropshire, 7th August, 1893.

Easily distinguished from its allies by the yellowish tomentose pileus, the bright yellow orifice of the pores, and the flesh turning red when broken and then finally becoming dark bistre.

Tremella Grilletii Boud. Soc. Bot. Fr. (1885) 284 t. 9, f. 4, Quél. Fl. Myc. 22.

At first globose or lenticular, 3-6 mm. wide, soon confluent and 3-5 cm. across, *greyish lilac, punctate,* pruinose, translucid. Spores white, hyaline, oblong, 8-9 × 2·5-3·5μ, straight or curved.

On a dead stick, Cambridge, 26th May, 1911, Mr. F. T. Brooks.

PHAEOTREMELLA Rea.

Fungi gelatinosi, versiformes, foliacei, lignicoli. Hymenium amphigenum. Basidia rotundata aut pisiformes, cruciatim septata, sterigmata 4 plus minusve elongata gerentia. Sporae coloratae.

Phaeotremella pseudofoliacea Rea. Vide t. 20.

Caespitosa, gelatinosa, foliacea, 4-10 cm. lata, laevis, undulata, basi plicata, pellucida, subcinnamomea. Sporae *umbrinae,* globosae vel late obovatae, 12 × 9-12μ. Conidia hyalina, elliptica, 9 × 6μ.

Easily known amongst the frondose Tremellaceae by its *coloured spores.* This species was first collected by myself on an old post in Wyre Forest, Shropshire, on the 5th of October, 1904, and was subsequently obtained at Staple Park, Somersetshire, during the Taunton foray on the 20th of September, 1911.

Galactinia ampelina (Quél.) Boud. Quél. 12, Suppl. Champ. Jura et Vosges 12, t. VII., fig. 5. Quél. Enchir. Fung. 279. Boud. Bull. Soc. Myc. I., 101. Ic. Myc. IV., 166, pl. 300, and see pl. 20.

Medium size from 1·5-4 cm. wide, sessile, disc brownish violet, externally greyish white. Ascophore sessile, cup-shaped, glabrous or very finely furfuraceous and greyish white on the

outside, hymenium slightly undulate and more or less flattened. Paraphyses linear, filled with coloured globules or oblong shaped bodies of protoplasm. Asci large, narrow, attenuated at the base, 350-400 × 15-17μ, eight-spored and becoming blue on the application of iodine. Spores white, oblong-elliptic, 20-22 × 10-12μ, smooth, 2 to many-guttulate.

On bare soil near a rotten stump of Abies excelsa, Swarraton, Hants, 30th March, 1911, Rev. W. L. W. Eyre.

This determination was kindly verified by our member Monsieur Emile Boudier.

Rhyparobius dubius Boud. Mém. Ascob. 50. Pl. X. f. 26, var. *lagopi* Boud. (MS).

Ascophores scattered, immersed, very minute, 150μ across, pale grayish, containing from ten to fifteen asci. Asci broadly cylindric-clavate, 55-100 × 18-20μ. Spores 128, hyaline, smooth elliptical, 6-7 × 3·5-4μ. Paraphyses always present, clavate, × 4μ at the apex, exceeding the asci.

On grouse dung, Inver Woods, Dunkeld, Perthshire, 28th October, 1911, Mr. Charles McIntosh.

"Une variété distincte du type par ses theques plus allongées et ses spores un peu plus grandes. Elles sont au nombre d'au moins 128 comme chez *R. dubius* mais l'habitat aussi diffère."

Mr. McIntosh informs me that he found the type last year both on roe dung and rabbit dung but the ascophores only contained from one to four asci and the paraphyses were generally absent, whereas in the variety the ascophores contained about ten asci and the paraphyses were always present.

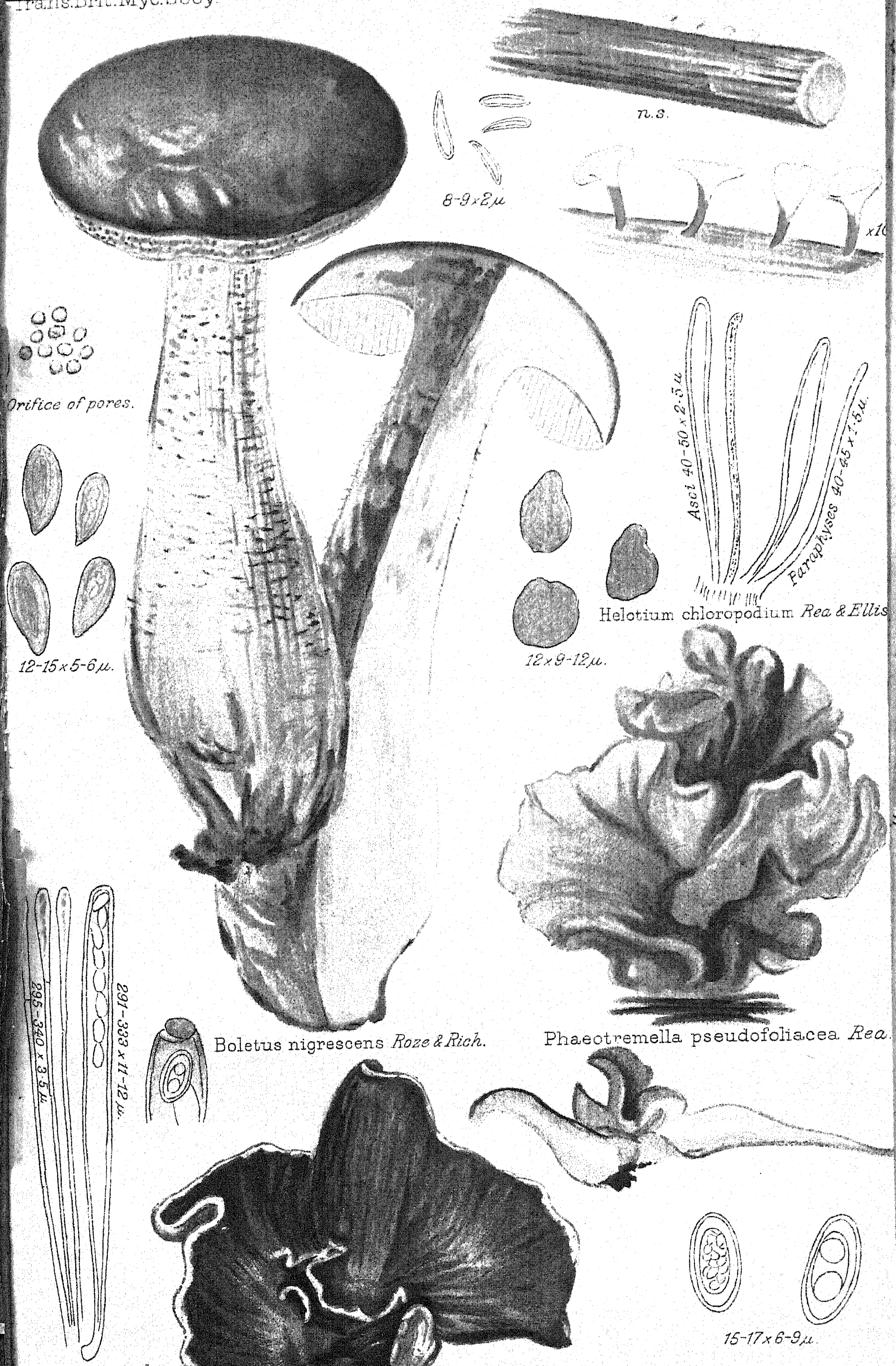
Monsieur Boudier also found on the same dung specimens of *Sporormia lagopina* Bres. which he considers Saccardo (Syll. XIV., 377) wrongly makes a variety of *S. intermedia* Auersw.

Mitrula sclerotipus Boud. Bull. Soc. Bot. Fr. (1877) 309, t. IV., f. v. Icon. Mycol. III., pl. 428, IV. 245.

Very small, 1·5-2 cm. long, yellowish ferruginous, club oblong, shorter than the stem. Club elongate, clubshaped, generally narrower at the base, separated from the stem by a distinct groove, solid, flesh white or concolorous when moist. Stem stuffed, simple, occasionally bifurcate or trifurcate, springing from a well developed sclerotium. Paraphyses shorter than the asci, hyaline, granular inside. Asci fusiform, 45-50 × 5-7μ. Spores 10-13 × 3-3·5μ, filled with multigranular protoplasm.

On boggy ground of a bank near an old mill dam, 5th November, 1911, Mr. James Menzies.

The spores in the Scottish specimens only measured 6-8 × 2·5-3μ.



Helotium chloropodium *Rea & Ellis*

Boletus nigrescens *Roze & Rich.*

Phaeotremella pseudofoliacea *Rea.*

Galactinia ampelina *(Quél.) Boud.*

E. A. Rea del.

West, Newman chr.

CORYNELLA Boud. Discomycètes d'Europe 99.

Ascophore round or cushion-shaped, glabrous, bright coloured, greenish or olivaceous. Asci small, pretty wide, 8-spored, foramen immarginate. Paraphyses thin, branched, not thickened at the apex. Spores oblong or slightly fusiform, guttulate at first and finally multiseptate.

Corynella glabro-virens Boud. Bull. Soc. Bot. Fr. XXVIII., 95. Pl. III., f. 8; Icon. Mycol. IV., 265. Pl. 458.

Very minute ·30-·60 mm. wide; cups hemispherical, smooth, shining, emerald green, deeper in colour at the margin, translucent. Hymenium plane or slightly convex, papillate with the projecting asci. Paraphyses septate, thin, branched, not thickened at the apex. Asci 8-spored, very attenuated at the base, $70\text{-}100 \times 10\text{-}14\mu$, foramen immarginate. Spores white, oblong, $12\text{-}15 \times 3\text{-}5\mu$, slightly curved, very distinctly triseptate, filled with granules at first which entirely disappear at maturity.

On dead wood lying amongst decaying leaves, Eastham, Cheshire, 29th June, 1911, Dr. J. W. Ellis, Buncombe, and Knocknanny Wood, Westport, Ireland, 4th October, 1911.

Helotium chloropodium Rea & Ellis. Vide t. 20.

Ascomata sparsa, stipitata, ceracea, alba, hyalina, ·75-1 mm. lata, e pyriforme explanato-convexa, margine tenui, plano vel leniter fimbriato propter ascos projectos. Stipes ·75-1 mm. longus, gracilis, equalis, apice albus, hyalinus, basi *chlorinus ad tertiam vel dimidiam partem.* Asci clavato-subfusoidei 40-50 $\times 2{\cdot}5\mu$. Sporae fusoideo-clavatae, rectae, hyalinae, continuae, $8\text{-}9 \times 2\mu$. Paraphyses lineares ad apicem paululum incrassatae, intus minutae granulosae, $40\text{-}45 \times 1{\cdot}5\mu$.

Ad caules emortuos. Brignall Banks, Yorkshire, 5th June, 1911. Legit Dr. J. W. Ellis. Helotio nubilipedi Boud. affinis.

Easily known by its chlorine green diaphanous stem. Specimens were submitted to Monsieur E. Boudier, who agreed that this was an undescribed species.

Tapezia retincola (Rabh.) Karst. Rev. Mon. 137.

On dead stems of *Phragmites communis*, Mere side, Hornsea, Naturalist (1909) 179.

Mollisia ramealis Karst. Myc. Fenn. I. 187.

Gregarious, sessile, convex or plane, fuscous or becoming fuscous on the outside, disc whitish or white at first becoming ochraceous when dry, round or sometimes irregular in shape, about 1 mm. wide. Asci narrowly clavate, apex narrowed, 75-$90 \times 7\text{-}8\mu$, becoming slightly blue when treated with iodine.

Spores biseriate, cylindric-fusiform, straight or slightly curved, guttulate either pseudo-uniseptate or eguttulate, greenish-hyaline, $14\text{-}30 \times 2\text{-}3\mu$. Paraphyses scanty, very slightly enlarged at the apices.

On a dead Oak branch, Raby Woods, Durham, 6th June, 1911, Dr. J. W. Ellis. The spores in these specimens measured $24\text{-}30 \times 4\text{-}5\mu$.

This species was kindly identified by our member Monsieur Emile Boudier.

Hypocrea pulvinata Fckl. (Symbolae 185.)

Stroma cushion-shaped, superficial, 2-4 mm. wide, pale greenish yellow, powdery felted. Perithecia immersed, short, round, with a slight projecting punctiform mouth. Asci cylindrical, stalked, eight-spored, $60\text{-}70 \times 4\mu$. Spores monostichous, made up of two equal, hyaline, round cells, which afterwards separate, $\times 4\mu$.

On decaying pilei of *Polyporus betulinus*, Inver, Perthshire, Mr. Charles McIntosh, 14th July, 1911.

Hypocrea lactea Fr. (Summa 383).

Stroma thin, flat, widely outspread, fleshy, glabrous, milk white, often over 5 cm. wide, circumference naked. Perithecia, immersed, round with a punctiform mouth. Spores made up of two almost equal, round, hyaline cells $\times 3\mu$.

On rotten wood, Staple Park, Somersetshire, 20th September, 1911.

Acremoniella atra (Cda.) Sacc. Fung. Ital. 713.

On moss and dead leaves, Castle Howard. Naturalist (1911) 166.

Cercospora Calendulae Sacc. Michelia I. 267.

On cultivated Marigolds in the Inn garden, Welburn, Castle Howard. Naturalist (1911) 166.

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* This should now be Stilbella.

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